132-174 MC
1.4W RF POWER

MOTOROLA

"handie-talkie" ®

fm radiophone

PRINTED IN U. S. A.

68P81012A25-B

MODEL H23DCN-1100A/W
TYPE CC3506
SER. No. E 50312

MOTOROLA

HANDIE-TALKIE

FM RADIOPHONE

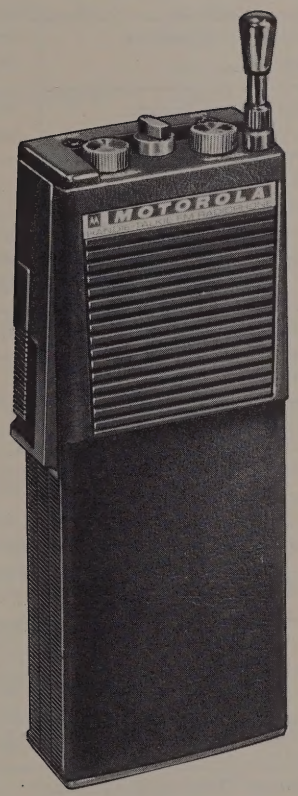
CARRIER AND DUAL SQUELCH

1.4 W RF POWER

132-174 MC

PORTABLE TRANSISTORIZED

AEPD-8179-



MODEL H23DCN-1000A

MOTOROLA INC.
COMMUNICATIONS DIVISION
Engineering Publications
4501 W. Augusta Blvd.
Chicago 51, Illinois

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6/13/63-UP

68P81012A25
Issue - B

GUARANTEED PERFORMANCE SPECIFICATIONS

GENERAL

MODELS		H23DCN-1000 Series	H23DCN-3000 Series
POWER SUPPLY		(1) Mercury battery, 16.8 volts; or (1) Nickel-Cadmium battery, 14.4 volts	
BATTERY DRAIN (at 14 volts)	Standby	4 ma	9 ma
	Receive	55 ma	60 ma
	Transmit	350 ma	355 ma
BATTERY LIFE (based on 10% transmit, 10% receive with rated audio output, and 80% standby)		Mercury battery - 60 hours Nickel-Cadmium battery- 8 hours per charge	Mercury battery 52 hours Nickel-Cadmium battery- 8 hours per charge
DIMENSIONS		1-13/16" x 3-3/8" x 8-1/4"	
WEIGHT		With mercury battery 35 ounces	With mercury battery 36 ounces
		With nickel-cadmium battery; 34 ounces	With nickel-cadmium battery; 35 ounces

TRANSMITTER

RF OUTPUT	1.4 watts @ 14.0 volts primary power input
FREQUENCY STABILITY	±0.0025% from -30°C to +60°C (+25°C reference)
MODULATION	16F3: ±5 kc for 100% at 1000 cps; or 36F3: ±15 kc for 100% at 1000 cps
CRYSTAL MULTIPLICATION	18 times
SPURIOUS AND HARMONICS	More than 45 db below carrier
FM NOISE	At least 50 db below ±3.3 kc deviation at 1000 cps, or at least 50 db below ±10 kc deviation at 1000 cps
AUDIO RESPONSE	+1, -3 db of 6 db/octave pre-emphasis characteristic from 300 to 3000 cps
AUDIO DISTORTION	Less than 8% at 1000 cps, 2/3 rated maximum deviation

RECEIVER

MODULATION ACCEPTANCE*	±5 kc (split channel models) or ±15 kc (wide band models)
SENSITIVITY	Less than 0.5 microvolt for 20 db quieting
SPURIOUS AND IMAGE REJECTION	More than 70 db below carrier
NOISE SQUELCH SENSITIVITY	Noise compensated type: adjustable sensitivity, will open at less than 0.25 microvolt
TONE-CODED SQUELCH SENSITIVITY	Fixed sensitivity will open at less than 0.25 microvolt
AUDIO OUTPUT	500 milliwatts to speaker at less than 10% distortion
FREQUENCY STABILITY	±0.0025% from -30°C to +60°C (+25°C reference)
SELECTIVITY	More than 80 db at ±30 kc measured by the 20 db quieting method
CHANNEL SPACING*	30 kc (±5 kc Bandwidth) 60 kc (±15 kc Bandwidth)

*Tone-coded squelch available in split-channel (16F3) models only

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FCC LICENSE DESIGNATION: CC3506

FOREWORD

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

A model chart is located in the front of this manual.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model NTD6041AA becomes NTD6041AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with its issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
4501 W. Augusta Blvd., Chicago 51, Illinois

REPLACEMENT PARTS ORDERING

Motorola maintains parts and service depots and authorized service stations strategically located throughout the country. These facilities are fully equipped to give the finest service.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal type number, crystal frequency, carrier frequency and the chassis model number in which the crystal is to be used.

Orders for "Vibrasender", "Vibrasponder" and "Vibrasender-sponder" units should specify the type number and frequency and should identify the owner and operator of the communications system in which these items are to be used.

68P81009A97-C

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U. S. PATENTS:

	2,608,648	2,743,144	2,833,994	2,963,577
RE-24,110	2,608,649	2,743,361	2,834,879	2,966,585
RE-24,815	2,626,384	2,750,451	2,835,794	2,968,739
2,404,359	2,637,782	2,759,052	2,852,730	2,974,221
2,439,408	2,650,333	2,759,103	2,860,239	2,984,740
2,439,412	2,662,942	2,770,721	2,883,521	2,994,844
2,472,021	2,688,059	2,777,950	2,888,652	3,009,115
2,524,300	2,691,094	2,784,263	2,899,547	3,014,127
2,524,534	2,691,560	2,799,001	2,901,601	3,027,454
2,547,023	2,699,425	2,799,010	2,912,573	3,027,455
2,547,025	2,705,281	2,808,507	2,918,571	3,039,081
2,547,027	2,731,555	2,809,236	2,924,705	3,041,550
2,566,759	2,738,466	2,810,068	2,925,562	3,048,659
2,583,032	2,740,891	2,830,200	2,938,082	3,048,747
2,602,842				3,059,184

Other U. S. Patents Pending

CONTENTS

SECTION	PAGE
Guaranteed Performance Specifications	ii
Radio Set Model Chart	vi
Accessory Table	vii
DESCRIPTION AND OPERATION	
Description	1
Preoperational Notes	2
Operation	2
BATTERY REPLACEMENT AND CHARGING	
Battery Replacement Procedure	3
NLN6238A Nickel-Cadmium Battery Kit	4
THEORY OF OPERATION	
General	5
Circuit Theory	5
MAINTENANCE	
Test Equipment	8
Use of the Test Jig	10
Test Procedure	10
Disassembly Procedure	11
Receiver Stage Analysis	11
Transmitter Service Notes	15
Repair	16
SERVICE CHARTS AND DIAGRAMS	
Transmitter Alignment Procedure	19
IDC Adjustment Procedure	20
Receiver Alignment Procedure	21
Intercabling Diagram for Carrier Squelch Models	23
Intercabling Diagram for Dual Squelch Models	24
Transmitter Printed Circuit Board and Wiring Diagram	25
One-Frequency Receiver Printed Circuit Board and Wiring Diagram	27 & 29
Two-Frequency Receiver Printed Circuit Board and Wiring Diagram	31 & 33
NLD6160A "Private-Line" Printed Circuit Board and Wiring Diagram	35
Carrier Squelch Model Schematic Diagram and Parts List	37
Dual Squelch Model Schematic Diagram and Parts List	39

MOTOROLA

MODEL CHART

FOR

132-174 MC

"HANDIE-TALKIE" RADIOPHONES

CARRIER AND DUAL SQUELCH

CODE:

[X] = ONE ITEM SUPPLIED

[/] = ONE ITEM SUPPLIED PER FIVE (OR LESS) RADIO SETS

[2] = TWO ITEMS SUPPLIED

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL AS STAMPED ON THE CHASSIS IS DETERMINED BY ITS APPLICATION.

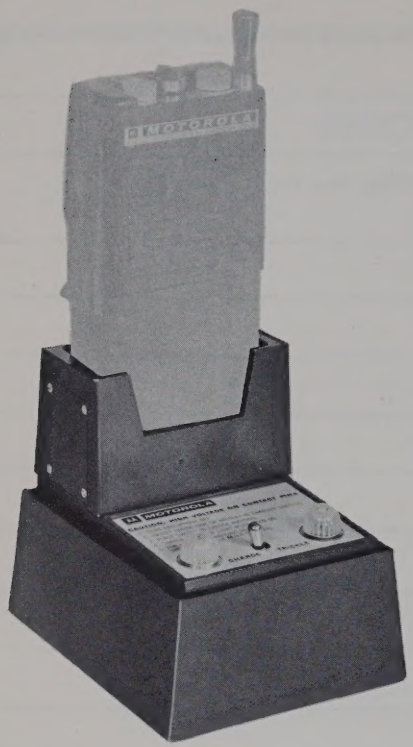
ITEM	DESCRIPTION	REFERENCE DIAGRAM	H23DCN-1000A	H23DCN-1010A	H23DCN-1030A	H23DCN-1100A	H23DCN-1110A	H23DCN-1130A	H23DCN-3100A	H23DCN-3110A
	NUMBER OF XMTR. FREQUENCIES		1	2	2	1	2	2	1	2
	NUMBER OF RCVR. FREQUENCIES		1	1	2	1	1	2	1	1
	CHANNEL SPACING		60 KC	60 KC	60 KC	30 KC	30 KC	30 KC	30 KC	30 KC
*NTD6050AA	TRANSMITTER (132-174 MC) ONE FREQUENCY: CARRIER SQUELCH	63E81012A26	X			X				
*NTD6050AB	TRANSMITTER (132-174 MC) TWO FREQUENCY: CARRIER SQUELCH	63E81012A26		X	X		X	X		
*NTD6050AC	TRANSMITTER (132-174 MC) ONE FREQUENCY: DUAL SQUELCH	63E81012A27						X		
*NTD6050AD	TRANSMITTER (132-174 MC) TWO FREQUENCY: DUAL SQUELCH	63E81012A27							X	
*NRD1130AA	RECEIVER (132-174 MC) ONE FREQ.: CARRIER SQUELCH: WIDE CHANNEL	63E81012A26	X	X						
*NRD1130AB	RECEIVER (132-174 MC) ONE FREQ.: CARRIER SQUELCH: SPLIT CHANNEL	63E81012A26				X	X			
*NRD1130AC	RECEIVER (132-174 MC) TWO FREQ.: CARRIER SQUELCH: WIDE CHANNEL	63E81012A26			X					
*NRD1130AD	RECEIVER (132-174 MC) TWO FREQ.: CARRIER SQUELCH: SPLIT CHANNEL	63E81012A26						X		
*NRD1130AF	RECEIVER (132-174 MC) ONE FREQ.: DUAL SQUELCH: SPLIT CHANNEL	63E81012A27							X	X
NLN6236A	KIT, REAR COVER	63E81012A26, 27	X	X	X	X	X	X	X	X
NHN6068A	KIT, HOUSING: ONE FREQUENCY: CARRIER SQUELCH	63E81012A26	X			X				
NHN6069A	KIT, HOUSING: TWO FREQUENCY: CARRIER SQUELCH	63E81012A26			X			X		
NHN6070A	KIT, HOUSING: ONE FREQUENCY: DUAL SQUELCH	63E81012A27							X	
NHN6071A	KIT, HOUSING: TWO FREQUENCY: DUAL SQUELCH	63E81012A27								X
NHN6082A	KIT, HOUSING: TWO FREQ. XMIT: ONE FREQ. REC: CARRIER SQUELCH	63E81012A26		X			X			
NLD6160A	"PRIVATE-LINE" SQUELCH DECK								X	X
NLN6241A	"PRIVATE-LINE" HARDWARE KIT								X	X
NLN6245A	TUNING TOOL		/	/	/	/	/	/	/	/
TLN6492AA	"VIBRASENDER-SPONDER" UNIT								X	X
YN-19	CRYSTAL, TRANSMITTER		X	2	2	X	2	2	X	2
YM-35	CRYSTAL, RECEIVER CONTROL		X	X	2	X	X	2	X	X
YN	CRYSTAL, IF		X	X	X	X	X	X	X	X

EPD-7998-B

ACCESSORY TABLE

MODEL	DESCRIPTION
NAD6082A	Telescopic antenna
NAD6092A	Whip antenna
NKN6065A	Plug-in mobile antenna adapter cable for connecting the radiophone to a mobile antenna
NSN6008A	Plug-in lapel speaker
NSN6009A	Plug-in earpiece
NLN6257A	Carrying case (Black)
NLN6256A	Carrying case (Brown)
NLN6032A	Brown leather belt
NLN6042A	Black Leather belt
NLN6253A	Carrying strap cord and swivel assembly kit
NLN6254A	Carrying Strap (Brown)
NLN6255A	Carrying Strap (Black)
NEN6035A	Test jig for servicing radiophone
NLN6259A	Battery charger for recharging nickel-cadmium battery Battery may be charged while in or out of the radiophone
NLN6238A	Rechargeable nickel-cadmium battery kit
NLN6239A	Mercury battery kit (Mallory part number 303314).

ACCESSORIES



NLN6259A UNIT
BATTERY CHARGER

NAD6082A
TELESCOPIC ANTENNA

NAD6092A
WHIP ANTENNA

NLN6256A OR NLN6257A
CARRYING CASE

NSN6009A
EARPIECE

NSN6008A
LAPEL SPEAKER

NKN6065A
ADAPTER CABLE

NLN6238A NICKEL-CADMIUM
BATTERY KIT

NLN6239A MERCURY
BATTERY KIT

AEPD-7969-O(MC7924) AEPD-7901-O(MC6489) AEPD-7900-O(CE2020) AEPD-7982-O(MC7844)
AEPD-7988-O(MC7845) CE1686H MC7871 AEPD-8159-O(MC7991) AEPD-8158-O(MC7991)

DESCRIPTION AND OPERATION

1. DESCRIPTION

a. General

The completely transistorized Motorola "Handie-Talkie" FM radiophone described in this manual is a portable, hand-held, two-way, communications unit. It is a battery powered radio capable of two-way communications with any FM radio set within range and operating on the same frequency. The unit is weatherproof and may be carried in a pocket. The radiophone provides 1.4 watts r-f output at nominal battery voltage.

b. "Private-Line" Feature

Motorola "Private-Line" radios are especially useful when operating under crowded channel conditions. Several networks may share the same carrier frequency in the same area with a minimum of interference when each network uses a different "Private-Line" tone frequency.

The NLD6160A "Private-Line" Squelch Deck consists of the circuitry required for both transmitter and receiver "Private-Line" operation. The transmitter portion consists essentially of a tone oscillator which is actuated when the push-to-talk button on the radiophone is pressed. The transmitter is then modulated by a continuous audio tone signal in addition to the voice message.

The receiver portion of the NLD6160A "Private-Line" Squelch Deck consists essentially of a decoder. With the "Private-Line" circuit "on", only properly coded messages will be heard at the speaker. Uncoded or improperly coded signals will be excluded.

c. Radiophone Housings

The following chart lists the housings available and their application.

MODELS	APPLICATION			
	DUAL SQUELCH	CARRIER SQUELCH	XMIT. FREQ.	REC. FREQ.
NHN6068A		X	1	1
NHN6069A		X	2	2
NHN6070A	X		1	1
NHN6071A	X		2	1
NHN6082A		X	2	1

2. PRE-OPERATIONAL NOTES

Use care when unpacking and handling the "Handie-Talkie" radiophone. Open the shipping carton and carefully remove all items. Check the contents to be sure that all items have been included.

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

IMPORTANT

The radiophone contains a battery. Extended storage of the equipment will reduce the operating performance due to reduction in battery voltage and life. If equipment is to be stored for a long period of time, remove the battery and store it in a cool place.

To place the radiophone in operation, remove the battery and reinsert it as indicated in the BATTERY REPLACEMENT AND CHARGING section of this manual.

3. OPERATION

a. To Turn On

Turn the volume control in a clockwise direction until a "click" is heard. This places the receiver in operation.

b. To Adjust Receiver Audio Volume

Turn the squelch control fully counterclockwise. On dual squelch models, turn the "Private-Line" ON-OFF switch to the OFF position. Adjust the volume control until the desired volume is obtained from the speaker.

c. To Adjust Squelch Control

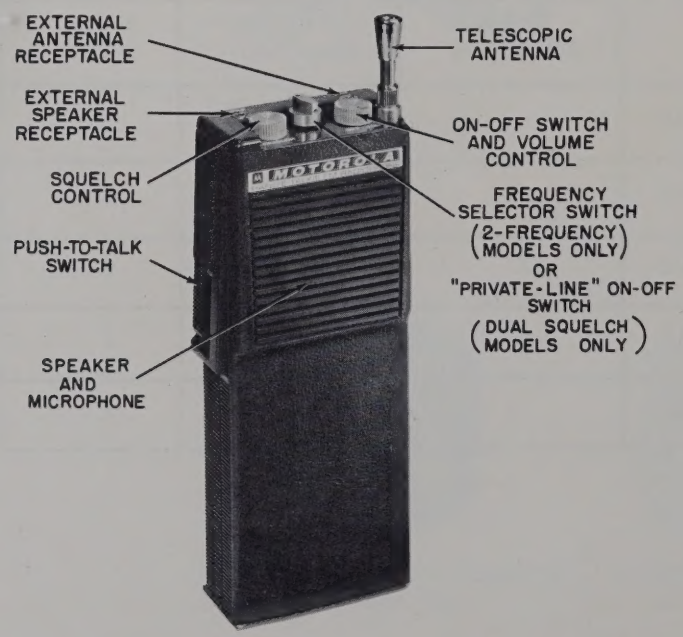
Turn the squelch control fully counterclockwise. On dual squelch models, turn the "Private-Line" ON-OFF switch to the OFF position. With no signal being received, turn the squelch control clockwise until the noise just cuts out (squelches).

d. "Private-Line" Operation (dual squelch models only)

For "Private-Line" operation, place the "Private-Line" ON-OFF switch in the ON position. All non-"Private-Line" and incorrectly coded "Private-Line" signals will then be blocked from the speaker. The squelch control is inoperative when the "Private-Line" ON-OFF switch is in the ON position and does not require adjustment.

NOTE

Before transmitting, momentarily place the "Private-Line" ON-OFF switch in the OFF position. This enables the operator to check for a clear channel and thus avoid breaking in on the transmission of another on-frequency unit.



CONTROLS LOCATION DETAIL

AEPD-8003-A (MC7880)

e. To Monitor

To monitor all "on-frequency" transmissions, turn the unit on and adjust the VOLUME and SQUELCH controls to the proper levels. On dual squelch models, the "Private-Line" ON-OFF switch must be OFF. To monitor only properly coded "Private-Line" transmissions, the "Private-Line" ON-OFF switch must be ON. The antenna should be extended for maximum sensitivity, however, for short range operation reception can be obtained with the antenna collapsed.

f. To Transmit

Extend the antenna and hold the speaker grill approximately one to two inches from the lips. Press the push-to-talk button in firmly and hold it. Speak slowly and clearly into the speaker grill in a normal-to-loud voice. Release the button to listen. The receiver is inoperative when the push-to-talk button is pressed.

g. Frequency Selection (Two-Frequency Models Only)

The rotary switch on the top of the unit may be turned to position F1 or F2 to select either of the two operating frequencies.

h. Antenna Jack

The Antenna Jack (ANT) is used for test purposes and for plugging in an external antenna. When this jack is used, the antenna which is part of the radiophone is disconnected.

i. Speaker Jack

The Speaker Jack (SPKR) is used for test purposes and for plug-in accessories such as the lapel speaker and earpiece. The built-in speaker is inoperative when this jack is used.

j. To Turn Off

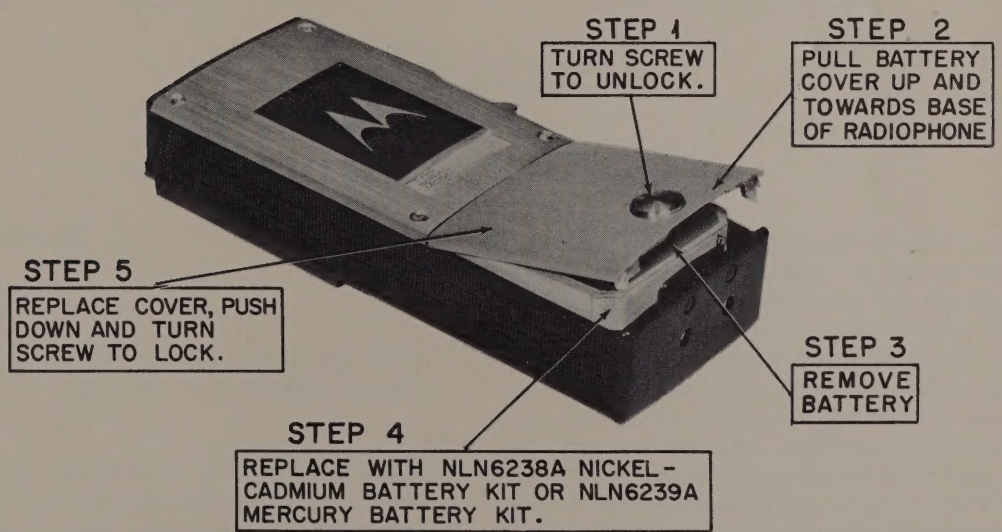
To turn the radiophone off, turn the volume control in the counterclockwise direction until a "click" is heard.

k. Storage

Remove the battery before storing the unit for a long period of time. If the radiophone is equipped with a nickel-cadmium battery see the storage instructions for the NLN6238A Battery Kit.

BATTERY REPLACEMENT AND CHARGING

1. BATTERY REPLACEMENT PROCEDURE


STEP 1
TURN SCREW TO UNLOCK.
STEP 2
PULL BATTERY COVER UP AND TOWARDS BASE OF RADIOPHONE
STEP 5
REPLACE COVER, PUSH DOWN AND TURN SCREW TO LOCK.
STEP 3
REMOVE BATTERY
STEP 4
REPLACE WITH NLN6238A NICKEL-CADMIUM BATTERY KIT OR NLN6239A MERCURY BATTERY KIT.

WARNING

Do not discard batteries in fire as they may explode.

NOTE

Place battery in battery compartment so the label may be read when the radiophone is held upright.

AEPD-7992-A(MC7853)

2. NLN6238A NICKEL CADMIUM BATTERY KIT

The NLN6238A Battery Kit, when used with an approved battery charger, provides a rechargeable source of d-c power for all models of the "Handie-Talkie" radiophone described in this manual. This kit consists of one 14.4 volt nickel-cadmium battery. The NLN6238A Nickel-Cadmium Battery Kit is completely interchangeable with the NLN6239A Mercury Battery Kit (Mallory part number 303314).

a. General

The operational characteristics of a nickel-cadmium battery under load are rather unique. The load voltage remains approximately constant until the battery approaches the discharged condition. At this time, there is a marked decrease in the load voltage and the discharged condition is reached abruptly. Metering to determine the state of charge of this type of battery is difficult and is not normally performed.

The battery requires no special storage precautions; it may be stored in any condition of charge or discharge without detrimental effects such as sulphation in lead-acid storage batteries. However, for storage periods in excess of approximately six months, it is recommended that the battery be kept in a discharged state. A general characteristic of a rechargeable battery is self-discharge.

It is difficult to predict charge retention after extended periods of storage. If the battery is to be used on an emergency basis after unknown storage periods, it is recommended that it be initially charged for 16 hours at the full charging rate then trickle charged until need for the battery arises.

b. Charging

Because of the sealed construction, the battery does not require the addition of electrolyte during its service life. Hence, the major maintenance problems normally associated with rechargeable batteries are completely eliminated. Maintenance consists only of recharging the battery and keeping the battery and its contacts clean.

The sealed-cell construction of the battery requires that the charger be designed as an integral part of the overall system. This is very important because damage to the battery will result if overcharge is continued beyond certain limits. Only an approved charger (see ACCESSORY TABLE) can be used, otherwise the manufacturer's warranty covering the replacement of the battery during its service life is VOID.

CAUTION

Avoid accidental short circuits. Sustained high rate discharges will damage the battery.

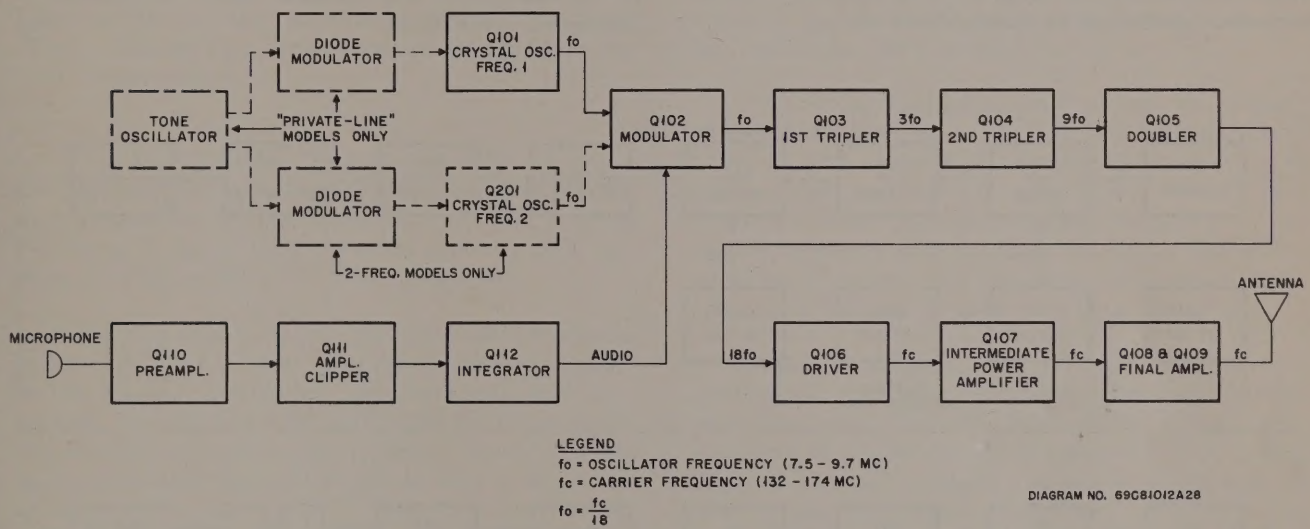
THEORY OF OPERATION

1. GENERAL

The "Handie-Talkie" radiophone consists of a crystal controlled transmitter and receiver operating in the 132-174 mc frequency range. The transmitter contains an audio section and an r-f section. The audio section consists of a dynamic microphone, an audio preamplifier, an amplifier-limiter, and an integrator stage. The r-f section consists of a crystal oscillator, a modulator, two frequency triplers, one frequency doubler, a driver amplifier, an intermediate power amplifier, and a final amplifier stage.

The receiver is a double conversion, super-heterodyne unit consisting of one r-f amplifier, two oscillators, two mixers, one first i-f amplifier, five second i-f amplifiers, a 455 kc filter, a limiter, discriminator, squelch amplifier, noise rectifier and three audio amplifiers.

Dual squelch "Private-Line" models include additional stages, some of which are shared by both the transmitter and receiver. The common stages are a "Vibrasender-sponder" circuit tone amplifier circuits and a "Vibrasender-sponder" driver. High and low pass filters are unique to the receiver and a diode modulator is unique to the transmitter.



69C81012A28-B

TRANSMITTER BLOCK DIAGRAM

2. CIRCUIT THEORY

a. Transmitter

The built-in dynamic microphone produces a low level audio output which is directly coupled to preamplifier, Q110.

The next two stages are part of the "Instantaneous Deviation Control" (IDC) circuit. Since the transmitter is phase modulated, the frequency deviation is dependant upon both the amplitude and frequency of the audio signal applied to the modulator. The combination of the integrator and the phase modulator has a "flat" response since the pre-emphasis characteristics of the phase modulator is offset by the de-emphasis of the integrator. Therefore, the frequency deviation of the modulator system is only dependant upon the amplitude of the input to the integrator. The amplitude of the audio signal is limited in the amplifier-clipper stage before reaching the integrator, thereby, limiting maximum deviation to a fixed value within the desired frequency range. Audio frequencies above 3000 cps are attenuated in the "splatter" filter before reaching the integrator.

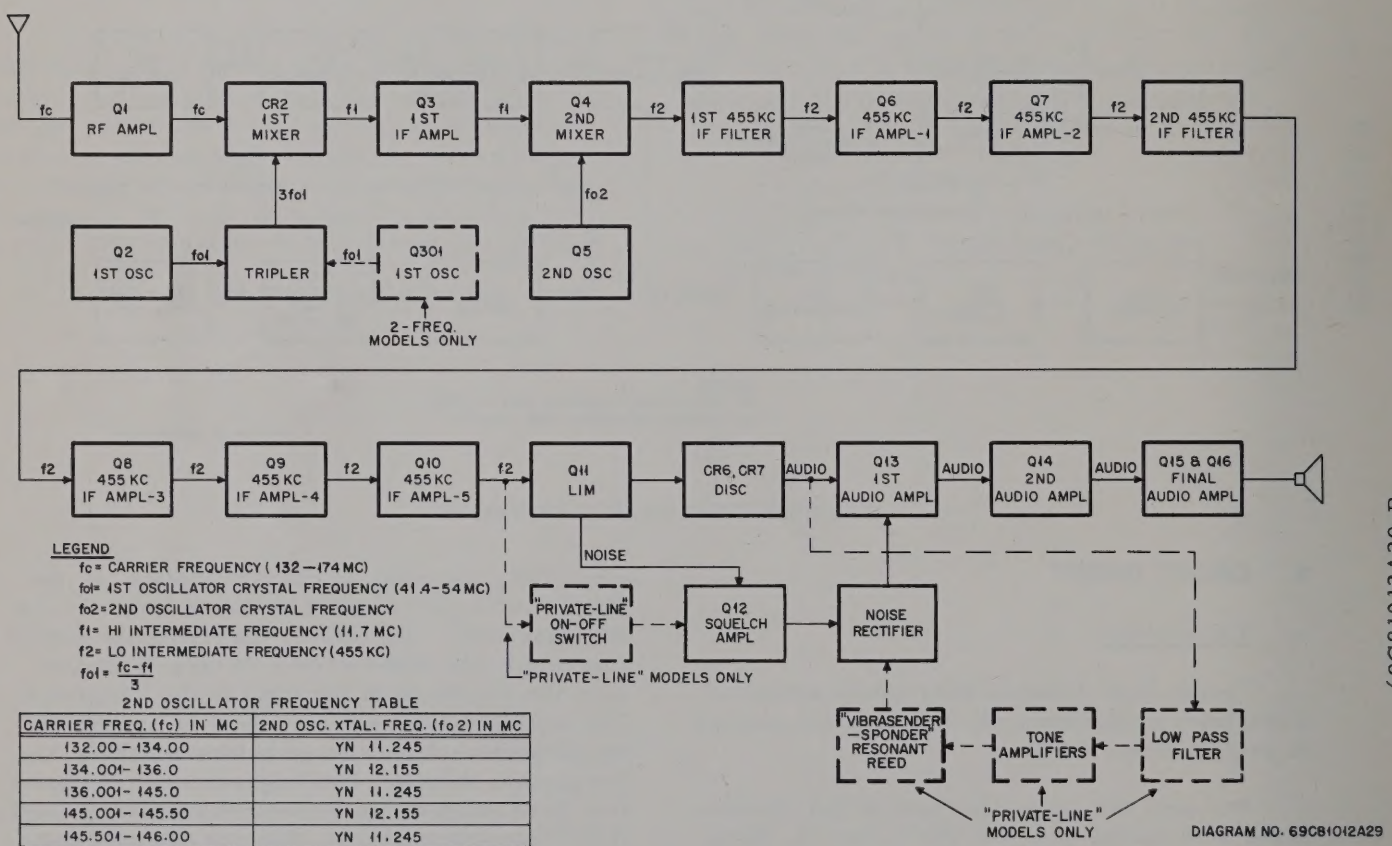
Oscillator stage, Q101 and (Q201 in 2-frequency units) is a fundamental, crystal-controlled,

anti-resonant oscillator circuit. It generates a radio frequency which is multiplied 18 times in the succeeding stages to produce the desired carrier frequency. A variable capacitor across the crystal permits a fine tuning adjustment (warping) for the proper operating frequency. The oscillator output is coupled to the modulator stage Q102.

RF is applied to the base and collector while audio is applied to the emitter of the modulator transistor. The internal r-f gain of transistor, Q102, is varied by the applied audio voltage. With a fixed phase shift circuit shunting the transistor and a variable phase shift through the transistor, an overall variable phase shift if obtained at the output. The variable inductance in the output of the modulator stages allows matching of the output reactance of the stage to insure minimum distortion and maximum linear deviation. Generally, phase modulators are capable of modulating with low distortion over a small phase angle. This necessitates the addition of frequency multiplier stages which increase the frequency deviation to the desired value.

Transistor frequency multipliers, or class B amplifiers, in general do not require forward biasing. Without signal drive, zero-biased class B frequency multiplier stage will not draw any emitter current. With drive present, the transistor will draw current and this current is easily monitored by measuring the d-c voltage developed across the emitter resistor. An exception to this is the first tripler stage, Q103, where, since the signal input level is very low, a small amount of forward bias is supplied to increase the gain of the stage.

Driver-amplifier stage, Q106, provides the proper amount of r-f voltage to drive the intermediate power amplifier (IPA). The IPA, Q107, and the final amplifiers, Q108 and Q109, increase the power output of the transmitter to the rated power output. Capacitor, C140, is set for the rated power output with minimum current and maximum efficiency. The last coil and capacitor (C139 and L111) are series tuned to reduce harmonic emissions.



LEGEND

fc= CARRIER FREQUENCY (132—174 MC)
fo1= 1ST OSCILLATOR CRYSTAL FREQUENCY (41.4-54 MC)
fo2=2ND OSCILLATOR CRYSTAL FREQUENCY
f1= HI INTERMEDIATE FREQUENCY (11.7 MC)
f2= LO INTERMEDIATE FREQUENCY (455 KC)
$fo1 = \frac{fc - f1}{3}$

2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (fc) IN MC	2ND OSC. XTAL. FREQ. (fo2) IN MC
132.00 - 134.00	YN 11.245
134.001- 136.0	YN 12.155
136.001- 145.0	YN 11.245
145.001- 145.50	YN 12.155
145.501- 146.00	YN 11.245
146.001- 150.80	YN 12.155
150.801- 157.0	YN 11.245
157.001- 157.60	YN 12.155
157.601- 168.0	YN 11.245
168.001- 169.0	YN 12.155
169.001- 174.0	YN 11.245

69C81012A29-B

RECEIVER BLOCK DIAGRAM

b. Receiver

The signal from the antenna is coupled to the r-f amplifier, Q1, where it is amplified before being injected into the first mixer. The oscillator, Q2, is a crystal controlled, series-resonant type. The crystal frequency is multiplied three times before being injected into the mixer. There, the incoming r-f signal and the oscillator frequency mix to produce the first intermediate frequency.

The first i-f signal is amplified in the next stage, Q3, and fed to the second mixer. The second mixer combines the first i-f signal and the output of the 2nd oscillator to produce the second i-f signal of 455 kc.

The 455 kc signal is selected in the first section of the "Permakay" filter, amplified in the two following stages, Q6 and Q7, and selected again in the second section of the "Permakay" filter. The 455 kc signal is then amplified in the next three stages.

The limiter stage removes any AM noise present on the incoming signal. The discriminator translates the variations of frequency of the i-f signal to an audio frequency signal which is then coupled to the first audio amplifier.

Squelch action is provided by taking the noise produced at the supply voltage decoupling point of the limiter, removing the residual 455 kc signal, amplifying that portion of the noise above the normal voice frequency range, rectifying this noise and applying it as positive bias to the base of the audio output stage. When the receiver is not quieted (in the absence of an r-f carrier), this bias cuts off the audio output stage and eliminates the speaker noise. The degree of squelch action is regulated by a potentiometer.

The audio section consists of three amplifier stages in series where the recovered audio is amplified to 500 milliwatts. The first two stages are directly coupled so that when the first stage is back biased by the squelch rectifier circuit, the second stage (driver) is also turned off. Since the third stage is class B and its current drain is minimal with no signal being fed to it, the audio drain under standby conditions is negligible.

c. Dual Squelch "Private-Line" Transmitters and Receivers

The controlling element in the "Private-Line" circuit is the "Vibrasender-sponder" unit. The unit acts similar to a control cyrstal in an oscillator stage. When the transmitter is keyed, a resonant reed inside the unit vibrates at a predetermined frequency. The resulting tone is then amplified in tone amplifiers. The amplifiers raise the signal to the proper level to drive the diode modulator, CR104. The diode modulator varies the first oscillator frequency at the tone frequency rate. Modulation is accomplished by varying the effective resistance of the modulator diode. This, in turn, varies the effective reactance of a capacitor in parallel with the crystal which modulates the oscillator frequency.

The noise squelch circuitry in the dual squelch "Handie-Talkie" receiver consists of a noise amplifier and a diode detector circuit which reverse biases the first audio amplifier. When the "Private-Line" switch is in the ON position, a signal from the 455 kc i-f is fed to the squelch amplifier, squelching the first audio amplifier whether or not a carrier signal is present.

When the incoming carrier contains the proper "Private-Line" tone frequency, the tone amplifier will drive the "Vibrasender-sponder" reed sufficiently to cause a contact closure. The contact closure is used to apply a negative voltage to the base of the first audio amplifier. The negative voltage overrides the positive voltage produced by the squelch amplifier and noise rectifier, thereby, unsquelching the audio amplifier.

This receiver makes use of two separate and distinct squelch circuits, i.e., tone-coded squelch and noise squelch. On dual squelch receivers, when the incoming signal is properly tone-coded, the squelch sensitivity is never greater than the tone-coded squelch sensitivity.

MAINTENANCE

1. TEST EQUIPMENT

All the required test equipment for aligning and testing the "Handie-Talkie" FM radiophone is listed in the following TEST EQUIPMENT CHART. The listed items or their equivalents may be used.

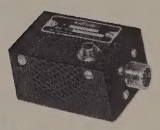
TEST EQUIPMENT CHART

EQUIPMENT	USED FOR
Motorola DC Multimeter with r-f probe	All d-c and r-f measurements. Monitoring the input current when external power supply is used.
Motorola AC voltmeter	All a-c signal measurements
FM signal generator - Motorola T1034B Signal Generator.	Alignment of all r-f and first i-f stages, 20 db quieting sensitivity measurements
455 kc crystal-controlled oscillator - Motorola S1056A-9A or TU546 Series Test Set with 455 kc crystal.	Alignment of 455 kc i-f limiter and discriminator stages
Audio generator - Motorola TEK-1A Transistorized Tone Generator, 1000 cps.	IDC Adjustment
Oscilloscope - Motorola T1015A General Purpose Oscilloscope or Motorola T1014B Precision Wide Band Oscilloscope.	IDC Adjustment
Motorola Model P-7208-A RF Dummy Load and a field strength meter.	All r-f output power measurements.
Motorola NLN6245A Alignment Tool (supplied with the radiophone).	Adjusting the variable capacitors and tuning coil slugs
Motorola NEN6035A Test Jig.	Holding the radiophone for alignment or testing, keeping the push-to-talk button depressed, applying external power.
DC power supply capable of supplying -14 v d-c at 400 ma (optional) Motorola T1012A Power Supply.	Supplying d-c power to the unit during extended servicing.

RECOMMENDED TEST EQUIPMENT

S1059A
TEST SET

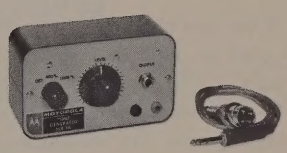
T1012A
POWER SUPPLY



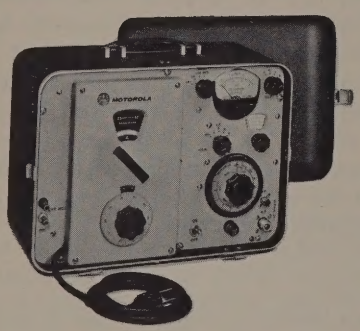
P-7208-A
DUMMY LOAD

S1063A
DC MULTIMETER

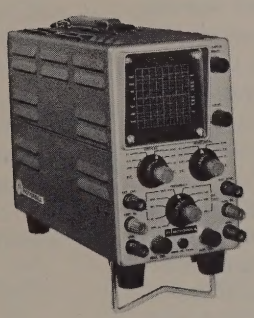
S1051B
TRANSISTORIZED AC
VOLTMETER



TEK-1A
TRANSISTORIZED TONE
GENERATOR

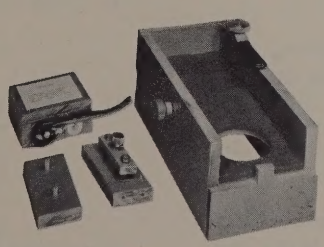


T1034B
SIGNAL GENERATOR



T1015A
GENERAL PURPOSE
OSCILLOSCOPE

T1014B
PRECISION WIDE BAND
OSCILLOSCOPE



NEN6035A
TEST JIG

AEPD-7707-O (MC7460) MC5744 MC1971 AEPD-7808-O (MC7763) AEPD-6901-O (MC7131) CE2114 AEPD-6684-O (MC5293)
AEPD-6626-O (MC6863) AEPD-7846-O (MC7794) AEPD-8168-O (MC8014)

2. USE OF THE TEST JIG

The Motorola NEN6035A Test Jig holds the FM "Handie-Talkie" radiophone while testing or aligning the unit. Normally, the radiophone is aligned in the test jig with the self-contained batteries used as the power source. For extended periods of time that may be required to check and service the radiophone, the unit can be placed in the test jig without batteries and an external power source used. A dummy battery, including power leads and polarity protection diode, is supplied with the test jig. A yoke is supplied to hold the receiver or the transmitter circuit board in position for servicing. The test jig includes a screw type knob to keep the push-to-talk button depressed for keying the transmitter.

a. Alignment

For normal alignment procedures, the battery can be left in the radiophone housing to power the unit. The unit is placed in the test jig face down. Refer to the Alignment Procedure for the photograph of the radiophone in the test jig. The knob on the test jig is turned clockwise to press against the push-to-talk button for keying the transmitter.

b. Extended Servicing

For extended periods of servicing or testing, it is recommended that an external power source be used. Remove the battery cover and battery from the battery compartment. Place the dummy battery in the unit. Make sure both contacts on the dummy battery make contact with their respective connection points on the radiophone. The test jig knob performs the same function as above. Connect the proper external power source to the test jig. It is recommended that a 0-500 d-c milliammeter be placed in series with the negative power lead to monitor the total input current.

3. TEST PROCEDURE

When a radiophone requires servicing, use the following procedures to localize the fault.

a. Check Batteries

The first step in localizing the trouble is to check the battery voltage under load. With the transmitter turned on (keyed), check the battery voltage. A convenient way to do this is to remove the battery cover and radio compartment cover as shown in paragraph 4. DISASSEMBLY PROCEDURE. Place the voltmeter ground lead on the speaker ground lug and measure the voltage at the transmitter A- input while the transmitter is keyed. The measured loaded voltage should be not less then 12 volts for either the mercury or nickel-cadmium batteries. Even though the transmitter may operate at this lower voltage, its operation would be marginal and for only a short additional period of time. The recommended procedure is to replace, or recharge, the batteries if the voltage is below 12 volts under load. Refer to the BATTERY REPLACEMENT AND CHARGING section of this manual for additional information.

NOTE

Only the nickel-cadmium batteries are rechargeable.

b. Check Overall Transmitter Operation

If the battery voltage is sufficient, check the overall performance of the transmitter. A good overall check of the transmitter is the r-f power output measurement. This one check indicates the proper operation of all the transmitter stages (oscillator, frequency multipliers, drivers and final amplifier) with the exception of the modulator and audio circuitry. A properly tuned and operating transmitter will produce at least 1.4 w r-f output into a 50 ohm load at a d-c input of -14 volts. It may be necessary to retune the output circuits slightly to match the 50-ohm load. This measurement should be made using a 50-ohm wattmeter connected to one end of the 50-ohm test cable with the other end connected to the external antenna jack.

For further details, refer to the Transmitter Alignment Procedure. If the power output is less than 1.4 w with a d-c input voltage of -14 volts, further checking is required. Refer to paragraph 6. TRANSMITTER SERVICE NOTES.

c. Check Overall Receiver Operation

(1) 20 DB Quieting Sensitivity Check

A good overall check of the receiver operation is the 20 db quieting sensitivity measurement. This check will indicate that the receiver has sufficient gain and that all the included cir-

cuitry is working properly. The quieting signal is that r-f signal input necessary to reduce the audio output at the speaker by 20 decibels. The measurement should be made in the absence of extraneous signals. Since the receiver squelch circuitry reduces the noise at the speaker, the squelch control should be set for maximum noise while making this measurement.

The actual measurement is made by observing the noise voltage at the external speaker jack on an a-c voltmeter with no r-f signal received at the antenna. Sufficient carrier signal from a recommended signal generator is then introduced via the external antenna jack to reduce the noise output voltage to 1/10 of the previous reading. If all circuitry is operating properly, the quieting signal should be 0.5 microvolt or less. Refer to the Alignment Procedure.

(2) Squelch Check

With no r-f input signal, set the squelch control until the speaker noise just cuts out (threshold squelch). Sufficient carrier signal from a recommended signal generator is then introduced until speaker noise is just heard. The signal level at which the squelch begins to open should be less than one-half the 20 db quieting sensitivity voltage measured in subparagraph (1).

(3) Audio Check

The last check to be made is the audio check. This procedure will test the audio circuits exclusive of the squelch circuitry. Refer to the AUDIO AMPLIFIER MEASUREMENTS CHART, which appears later in this manual, for typical measurements and procedures.

4. DISASSEMBLY PROCEDURE

To gain access to the component side of the chassis, follow the procedure as indicated in the following illustrations. To reassemble the radiophone, reverse these steps.

NOTE

To aid circuit tracing, the components side of the circuit board is screened in the pattern of the etched circuitry. This paint does not conduct and has no electrical function.

5. RECEIVER STAGE ANALYSIS

The information contained in the following paragraphs will aid the serviceman in localizing the trouble to a particular stage.

a. Test Points

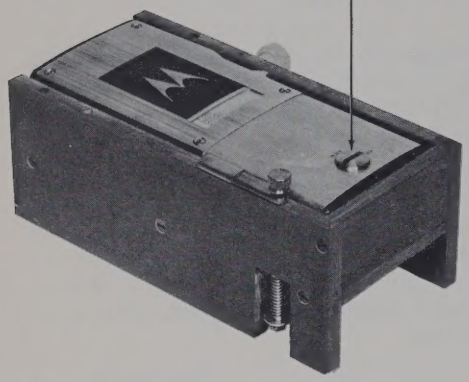
The test points on the printed circuitry are color coded for easy location. The locations of these test points may be seen on the alignment chart, the schematic diagram, and the wiring diagrams at the back of this manual.

b. Stage Measurements Charts

In addition to the 20 db quieting sensitivty measurement, all stage gain measurements can be checked against those shown in the following RF AND IF STAGE MEASUREMENTS CHART and AUDIO AMPLIFIER MEASUREMENTS CHART.

STEP 1

PLACE RADIOPHONE IN TEST JIG. UNLOCK BATTERY COMPARTMENT COVER.

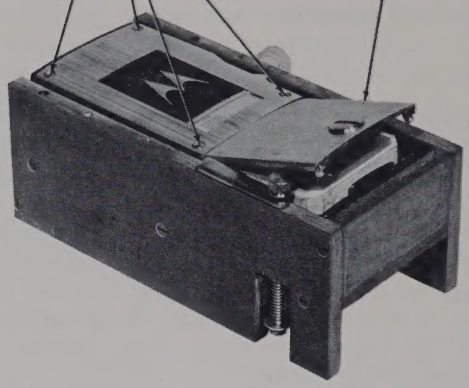


STEP 3

LOOSEN THE FOUR CAPTIVE SCREWS AND REMOVE RADIO COMPARTMENT COVER.

STEP 2

REMOVE BATTERY COMPARTMENT COVER BY LIFTING UP AND TOWARDS BOTTOM.

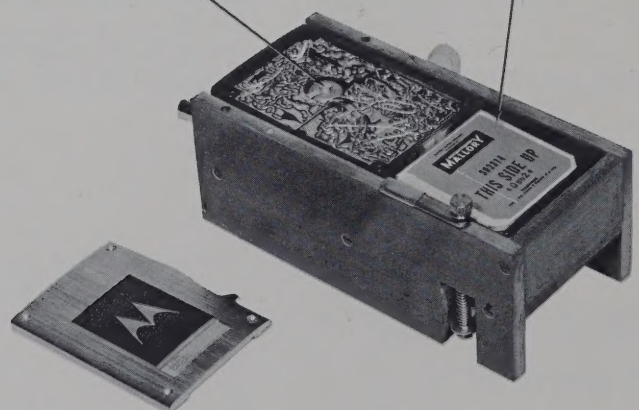


STEP 5

IF ACCESS TO THE COMPONENT SIDE OF THE PRINTED CIRCUIT BOARD IS REQUIRED, REMOVE THE SCREW HOLDING THE TRANSMITTER GROUNDING STRAP TO THE SPEAKER.

STEP 4

ALL NORMAL TUNING ADJUSTMENTS MAY NOW BE MADE. (SEE ALIGNMENT PROCEDURE.) IF EXTENSIVE TESTING IS REQUIRED REPLACE THE BATTERY WITH A DUMMY BATTERY (P/O TEST JIG) AND EXTERNAL POWER SUPPLY.



AEPD-7904-O (MC7872)

AEPD-7905-O (MC7873)

AEPD-7906-O (MC7874)

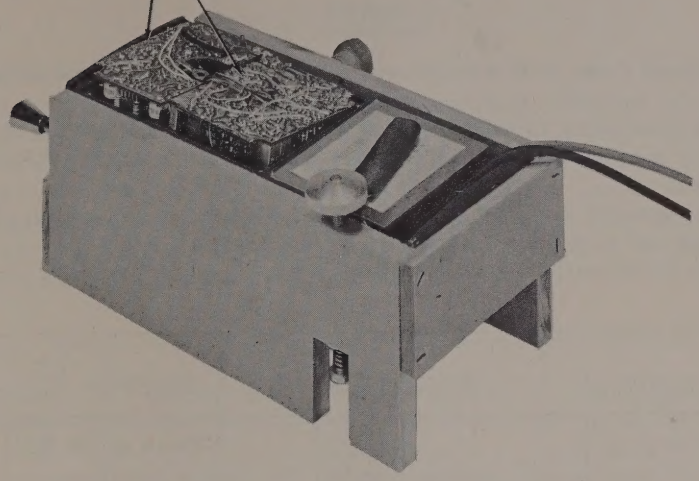
AEPD-8146-O(MC8013)

AEPD-8166-O(MC8017)

AEPD-8167-O(MC8016)

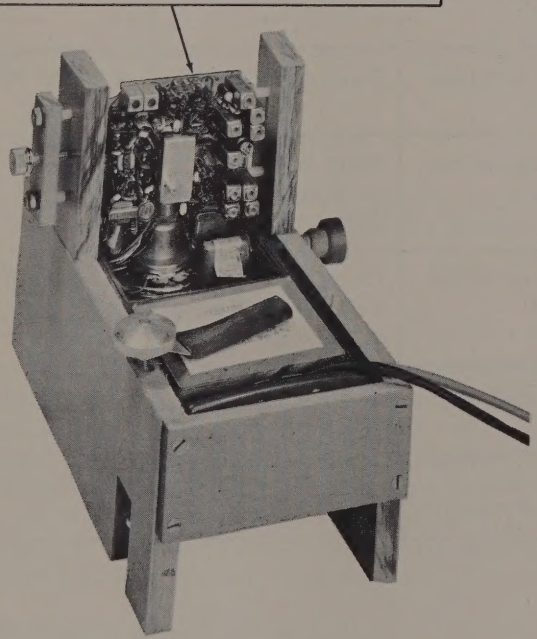
STEP 6

LIFT BOTH BOARDS SLIGHTLY TO CLEAR INTERCABLING.



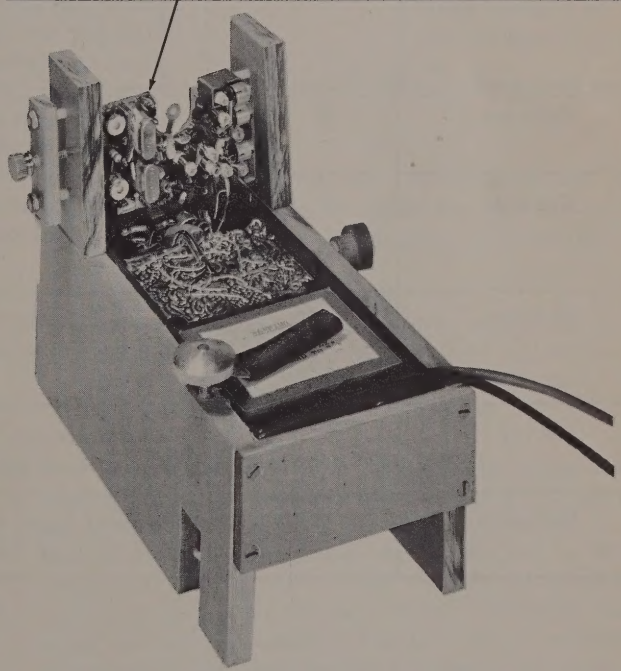
STEP 7A

FOR RECEIVER SERVICING: LIFT THE RECEIVER VERTICALLY UNTIL IT CLEARS THE PUSH-TO-TALK SWITCH. PLACE TEST BRIDGE IN MOUNTING HOLES FURTHEST FROM TOP OF RADIOPHONE AND MOUNT RECEIVER AS SHOWN.



STEP 7B

FOR TRANSMITTER SERVICING: LIFT TRANSMITTER VERTICALLY UNTIL ITS HEAT SINK CLEARS THE RECEIVER BOARD. MOUNT TEST BRIDGE IN MOUNTING HOLES NEAREST TOP OF RADIOPHONE. ROTATE THE TRANSMITTER AND MOUNT IN POSITION SHOWN.



RECEIVER RF AND IF STAGE MEASUREMENTS CHART

NOTES

1. Output readings taken with a Motorola Transistorized AC Voltmeter, or equivalent.
2. The carrier frequency is injected at the external antenna jack (J1) using a TEKA-36 RF Adapter Cable coupled to a Motorola Model T1034B Signal Generator, or equivalent.
3. The 1st i-f signal is injected at the points indicated in the chart using a 50 ohm coaxial cable and a series connected .02 uf capacitor.
4. All readings taken with -14.0 volts d-c input.

FREQUENCY	UV INPUT	PROCEDURE	OUTPUT AT	READING (NOTE 1)
-	Noise	-	Base of Q8 (M1)	-58 dbm (0.001 v)
-	Noise	-	Base of Q10 (M2)	-12 dbm (0.19 v)
-	Noise	-	Base of Q11 (M3)	-10 dbm (0.245 v)
-	Noise	- (Short collector of Q1 to collector coil ground with 100 uuf capacitor)	Base of Q8 (M1)	-62 dbm (0.0006 v)
-	Noise	- (Short collector of Q2 to collector coil ground with .02 uf capacitor)	Base of Q8 (M1)	-72 dbm (0.0002 v)
Carrier	6	Connect input to external antenna jack (J1)	Base of Q8 (M1)	-29 dbm (0.028 v)
Carrier	6	Connect input to external antenna jack (J1)	Input to second section of 455 kc filter	-20 dbm (0.077 v)
Carrier	100	Connect input to external antenna jack (J1)	Output of 1st section of 455 kc filter	-42 dbm (0.0062 v)
1st i-f	6	Connect input to 1st IF-1 (top of L6)	Base of Q8 (M1)	-29 dbm (0.028 v)
1st i-f	1000	Connect input to 1st IF-5 (top of T2 primary)	Base of Q8 (M1)	-33 dbm (0.017 v)

AUDIO AMPLIFIER MEASUREMENTS CHART

NOTES

1. Remove the GRN-RED lead from test point M4.
2. Connect an audio oscillator capable of generating 1000 cps, to this GRN-RED lead with a 47K ohm resistor in series.
3. Set the frequency and voltage according to the chart below. The input voltage is measured at the junction of the 47K ohm resistor and GRN-RED lead.
4. The output readings are referenced to ground unless otherwise indicated and are taken with a Motorola Transistorized AC voltmeter, or equivalent.
5. All measurements made with -14.0 volts d-c input.

FREQUENCY	VOLTS INPUT	INPUT TO	OUTPUT AT	READING	REMARKS
1000 cps	.02 (-32 dbm)	GRN-RED lead (top of volume control)	Base of Q13	-41 dbm (0.007 v)	Volume control set at maximum
			Collector of Q13	-9 dbm (0.28 v)	
			Base of Q14	-21 dbm (0.07 v)	
			Collector of Q14	+17 dbm (5.6 v)	
			Bases of Q15 and Q16	+17 dbm (5.6 v)	
			Collectors of Q15 and Q16	+16 dbm (5.0 v)	Measured at BLU wire leading to Ext speaker jack J2

6. TRANSMITTER SERVICE NOTES

The following information will aid the serviceman in troubleshooting the radiophone transmitter.

a. Metering Points

The test points on the printed circuit board are supplied for ease in checking. These points are indicated on the schematic diagram, wiring diagrams, and the photograph on the Alignment Procedure. The chart on the Alignment Procedure provides nominal voltage readings corresponding to these test points for a fully tuned transmitter with -14 volts d-c input.

b. DC Voltage Measurements

If the r-f power output is lower than normal for a fully tuned transmitter, the d-c voltages on the printed circuit board should be checked. These voltages should all be referenced to ground. A convenient location for the d-c multimeter ground lead is the speaker ground lug.

CAUTION

When checking a transistor, either in or out of the circuit, do not use an ohmmeter having more than 1.5 volts d-c appearing across the test leads.

The transistor is a dependable component and is not subjected to replacement as frequently as tubes. Therefore, the serviceman is cautioned not to replace transistors before a thorough check is made. The transistor terminal voltages should be checked first. If these voltages are not reasonably close to those specified, the associated components should be checked. A low impedance meter should not be used for measurement. If all d-c voltages are correct, the signal should be traced through the circuit to show any possibility of breaks in the signal path.

c. RF Signal Tracing

An r-f probe attachment for a d-c multimeter may be used to good advantage in checking the radiophone transmitter. The presence of r-f can be checked throughout the r-f circuitry for continuity of signal path. This would include the oscillator, modulator, frequency multipliers, and the driver and final amplifier. Following the heavy signal flow line through the r-f stages, as indicated on the schematic diagram, is recommended.

d. Frequency Multipliers

Transistor frequency multipliers, or class B amplifiers in general, do not require forward biasing. Without signal drive, a zero-biased, class B frequency multiplier stage will not draw any emitter current. With drive present, the transistor will draw current and this current is monitored best by measuring the d-c voltage developed across the emitter resistor. In the transmitter, these checks are made using test points M1, M2 and M3. The 1st tripler stage Q103 operates at a very low signal level. Therefore, a small amount of forward bias is supplied to increase the gain of this stage.

e. Driver, IPA and Final Amplifiers

The intermediate power amplifier (IPA) stage, Q107, has a metering point M4, which is used as an r-f metering point to indicate the presence of r-f voltage at the base of the transistor. When tuning up the driver, the intermediate power amplifier and the final amplifiers, it may be necessary to retune previously tuned circuits. This includes coils L107, L108, L109, L110 and L111 and capacitors C135 and C138. All these components interact to some extent. By using care in tuning these stages, rated power output will be obtained with minimum current drain.

f. Audio Circuits

If the transmitter does not modulate properly, the audio circuits should be checked to make sure that the audio modulating voltage is reaching the modulator. The audio circuit is a transistorized version of the Motorola audio and IDC circuit. External audio test signals can be coupled into the pre-amplifier stage Q110 by substituting the secondary winding of an audio transformer for the microphone. The secondary d-c resistance should be less than 500 ohms. Then, an audio signal is coupled to the primary of the transformer. In this manner, the audio circuitry can be signal traced.

The IDC control is a printed circuit potentiometer. Care should be taken when setting this control for the proper deviation.

CAUTION

Do not use a sharp metallic tool to adjust the IDC control. This may result in damage to the carbon track which could alter the resistance of the control.

7. REPAIR

The information contained in the following paragraphs will aid the serviceman in repairing the "Handie-Talkie" FM radiophone.

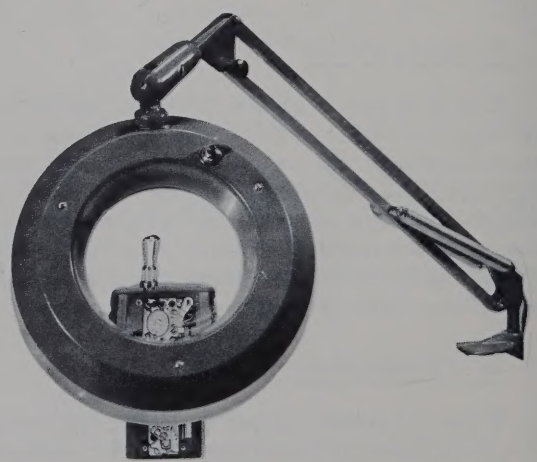
a. Construction

The various stages of the receiver and transmitter are built on printed circuit boards. These printed circuit boards mount and interconnect the components which comprise the radiophone. The boards may be easily removed from the housing for servicing. Refer to the paragraph on disassembly procedure. Components may be located by referring to the wiring diagrams and the parts location details at the back of this manual.

Do not apply the soldering iron repeatedly to the same spot in the printed circuit board as this will break down the plating. If a break exists in a printed circuit, it can be repaired by the addition of a jumper across the break. If a printed circuit should be damaged, refer to the TEK-4 Printed Circuit Repair Kit instruction manual for information on printed circuit repair practices.

b. Servicing Aids

Motorola has available several items which can be used to aid in parts replacement and repair of the printed circuit board.



MC7007

TEKA-12 MAGNIFYING GLASS & BUILT-IN LIGHT SOURCE

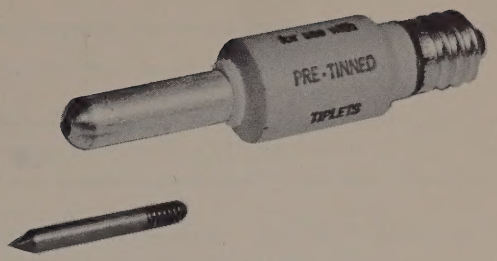
MC7922

MC4374

TEK-4 PRINTED CIRCUIT
REPAIR KIT

(1) Magnifying Glass

Miniaturization requires precision work both in manufacture and in field service. Adequate concentration of light and magnification are aids to service by enabling a visual examination of connections and miniature parts. The TEKA-27 or TEKA-12 Magnifying Glass & Built-In Light Source is a most satisfactory device for use in servicing miniature equipment in the shop. This large illuminated magnifying glass makes it easy to see any portion of the small components found on the printed circuit board. Refer to the accompanying illustration.



23-1/2 WATT
SOLDERING IRON ELEMENT
AND NEEDLE POINT TIPLET

(2) Printed Circuit Repair Kit

The TEK-4 Printed Circuit Repair Kit supplies most of the basic tools needed for work on printed circuitry and miniature components. The pencil-type soldering iron included in this kit, however, should be used with an element rated lower than 25 watts and a needle point tiplet. A 23-1/2 watt element (Part No. 535) and a needle point tiplet (Part No. PL-338) are not part of the kit but are available as optional accessories. Refer to the accompanying illustrations.

NOTE

The needle point tiplet for the soldering element may be filed to an even finer point to avoid damaging the closely knit printed circuitry.

c. Alignment Notes

If any element in a tunable stage is replaced or repaired, the associated stage should be aligned along with the stage that precedes and follows it. The alignment information is contained on the Alignment Procedure sheet toward the back of this manual. Refer to the Alignment Procedure sheet when a crystal is replaced or a new carrier frequency is required.

TEST EQ

1. Motorola NLN6245A
2. Motorola DC Multime
3. RF Wattmeter (50-oh
4. Motorola T1012A Pow
5. Motorola Model T113
6. Motorola TEK-1A Tr
7. Motorola T1014B Pre
   Oscilloscope or equiv
8. Motorola NEN6035A
9. Ammeter (0-0.5 amp

METE
READI

(

1. Place the unit face do
   in paragraph 4 in the
2. The d-c multimeter g
3. For complete alignme
   ammeter connected t
   unscrewed so they pr
4. Remove the antenna b
   ANT. jack using the t

$$f_0 = \frac{f_c}{18}$$ where: f

STEP	URE
1	any adjustment. L101 is adjusted for minimum
2	ower supply voltage to -12 volts d-c.
3	02 for maximum reading. Repeak several times l to three times the crystal frequency. uency and adjust L102 for a peak reading on the cies; adjust L103 and L102 until a balance is
4	ng. Repeak several times to obtain maximum rystal frequency.
5	ng. Repeak several times to obtain maximum he crystal frequency.
6	After peaking, readjust C135 for a reading
7	c.
8	, L110 and C138 for maximum output. If no cation and then adjust L111 for maximum output. um output. epeak L108 after each change in C135). Repeak or maximum output while minimizing the input ral times until 1.4 watts is obtained with mini- 50 MA TOTAL CURRENT DRAIN.
9	quency at the factory. Do not readjust C101 ccidentally changed. frequency monitor for frequency measurement, CARRIER FREQUENCY meter. Place the back . the frequency may shift, therefore recheck the ecessary, repeat this adjustment and recheck zero meter reading is obtained with back cover TTER ONLY above, substituting C201 for C101.
10	side of this chart for adjusting the IDC control

TEST EQUIPMENT REQUIRED FOR TRANSMITTER ALIGNMENT

1. Motorola NLN6245A Alignment Tool (supplied) or equivalent.
2. Motorola DC Multimeter with r-f probe or equivalent.
3. RF Wattmeter (50-ohm impedance).
4. Motorola T1012A Power Supply or equivalent.
5. Motorola Model T1130A Series FM Station Monitor or equivalent.
6. Motorola TEK-1A Transistorized Tone Oscillator or equivalent.
7. Motorola T1014B Precision Wide Band Oscilloscope or Model T1015A General Purpose Oscilloscope or equivalent.
8. Motorola NEN6035A Test Jig.
9. Ammeter (0-0.5 amp scale).

NOMINAL VOLTAGE READINGS

NOTE

The following readings apply to a fully tuned transmitter with -14 v d-c input.

METER POINT	M1 BRN	M2 RED	M3 ORG	M4 YEL
READING (V DC)	-1.8	-3.2	-0.3	-0.9*

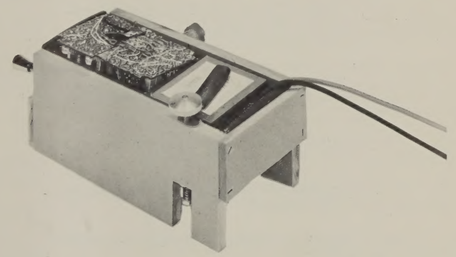
(*MEASUREMENT MADE WITH RF PROBE)

PRELIMINARY SET-UP FOR TRANSMITTER ALIGNMENT

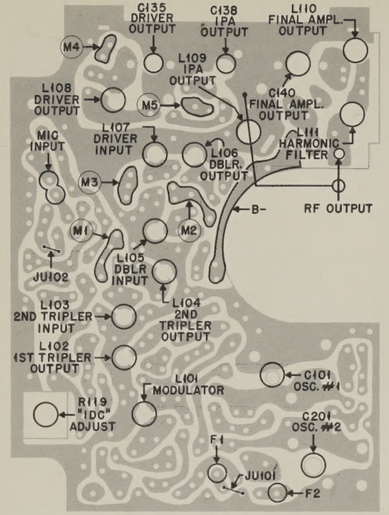
1. Place the unit face down in the test jig and remove the back cover from the radiophone as shown in paragraph 4 in the MAINTENANCE section.
2. The d-c multimeter ground lead should be connected to the speaker ground lug.
3. For complete alignment, the battery should be removed and a 14 volt d-c power supply and ammeter connected to the dummy battery of the test jig. All tuning slugs except L101 should be unscrewed so they protrude 1/8 inch above the printed circuit board.
4. Remove the antenna by unscrewing it from the receptacle. Connect a wattmeter to the external ANT. jack using the test cable.

FREQUENCY CALCULATION

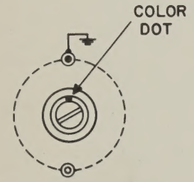
$f_0 = \frac{f_c}{18}$ where: f_0 = oscillator frequency and f_c = carrier frequency



RADIOPHONE
IN TEST JIG



METERING AND
ALIGNMENT POINTS



NOTE

To adjust C135, C138, C140, C101 or C201 for maximum capacity, turn screwdriver slot so color dot is nearest the grounded side of the capacitor.

STEP	TEST EQUIPMENT	METER POINT & COLOR	ADJUSTMENT	PROCEDURE
1	----	----	L101	For initial alignment, it is not necessary to make any adjustment. L101 is adjusted for minimum distortion in Step 11.
2	----	----	----	Key the transmitter momentarily and adjust the power supply voltage to -12 volts d-c.
3	DC Multimeter	M1 (BRN)	L102 L103 1st Tripler	SINGLE FREQUENCY TRANSMITTER: Adjust L103 for a peak reading and then adjust L102 for maximum reading. Repeak several times to obtain maximum reading. This circuit is tuned to three times the crystal frequency. TWO FREQUENCY TRANSMITTER: Adjust L103 for a peak reading on the higher frequency and adjust L102 for a peak reading on the lower frequency. Switch between the two frequencies; adjust L103 and L102 until a balance is obtained.
4	DC Multimeter	M2 (RED)	L104 L105 2nd Tripler	Adjust coils L104 and L105 for a maximum reading. Repeak several times to obtain maximum reading. This circuit is tuned to nine times the crystal frequency.
5	DC Multimeter	M3 (ORG)	L106 L107 Doubler	Adjust coils L106 and L107 for a maximum reading. Repeak several times to obtain maximum reading. This circuit is tuned to eighteen times the crystal frequency.
6	DC Multimeter with r-f probe	M4 (YEL)	L108 C135 Driver	Adjust L108 and C135 for maximum r-f reading. After peaking, readjust C135 for a reading of 3/4 maximum.
7	RF wattmeter	----	----	Increase the power supply voltage to -14 volts d-c.
8	RF wattmeter	----	----	Adjust C140 for maximum capacity. Adjust L109, L110 and C138 for maximum output. If no output can be obtained, adjust C140 for some indication and then adjust L111 for maximum output. Repeak L110, C140 and L109 and C138 for maximum output. Adjust C135 for approximately 1.4 watts output (repeak L108 after each change in C135). Repeak L111, L110, C140, L109, C138, L108 and L107 for maximum output while minimizing the input current. Readjust C135 and repeat this step several times until 1.4 watts is obtained with minimum current drain. ***NOTE*** - DO NOT EXCEED 350 MA TOTAL CURRENT DRAIN.
9	----	----	----	OSCILLATOR: C101 is preset to the assigned frequency at the factory. Do not readjust C101 unless the crystal is replaced or the setting was accidentally changed. If it is necessary to readjust C101, set up the frequency monitor for frequency measurement, and adjust C101 for zero reading on the monitor CARRIER FREQUENCY meter. Place the back cover on the transmitter unit and tighten securely. ***IMPORTANT*** - When the cover plate is attached, the frequency may shift, therefore recheck the carrier frequency on the frequency monitor. If necessary, repeat this adjustment and recheck procedure compensating for the variations until a zero meter reading is obtained with back cover securely attached to unit. TWO-FREQUENCY TRANSMITTER ONLY OSCILLATOR NO. 2: Use the same procedure as above, substituting C201 for C101.
10	----	----	----	DEVIATION CHECK: See IDC ADJUSTMENT procedure on the reverse side of this chart for adjusting the IDC control and the "Private-Line" tone deviation.

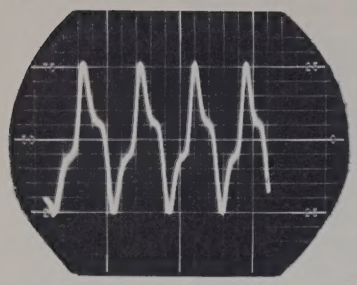


Figure 2.
kc Peak Deviation as seen on the Oscilloscope
(NOTE: Waveform is clipped fully)

ler-sponder" resonant reed from its socket.

input signal to 1.5 volts. This should drive the IDC circuit into full clip.

al level adjust the IDC control on the transmitter to provide a peak-to-
oscilloscope of 10 squares, which is equivalent to ±5 kc deviation as
veform under the above conditions does not resemble the waveform shown
symmetrical waveform is obtained. Readjust the IDC control.

ɔut to 0.25 volt. Essentially full deviation should still be observed on the
deviation may indicate a weak audio transistor or other lack of audio gain.

ɔs tone signal. Insert the "Vibrasender-sponder" unit in its socket.

-Line" tone deviation. This may be read directly from the oscilloscope by
h-to-talk switch on the test set. The tone deviation should be 0.5 to 1 kc.

NOTE

e tone deviation is less than 0.5 kc with jumper JU701
ɔsition 2 (see circuit board diagram), move the jumper
ɔsition 3. If the deviation is greater than 1.0 kc, move
umper to position 1. Always choose the jumper posi-
which produces a tone deviation between 0.5 and 1.0 kc.

ease in discriminator response at the lower frequencies, the oscilloscope
cation of 1.4 to 2.8 squares (peak-to-peak) is equivalent to 0.5 to 1 kc.
important when checking tone deviation. When setting maximum trans-
d below, it may be ignored.

st tone to the base of the amplifier-clipper stage Q111. Place a 0.33 uf
tone generator output.

input signal level for 1 volt and note the resultant combined deviation of
tone signal modulation on the oscilloscope.

the transmitter should be adjusted to provide a peak-to-peak combined
lent to full 5 kc as shown in figure 3.

otorola
aragraph

er Cable

1/2 watt
speaker

STEP	URE
1A	ading on the meter.
1B 2-freq. models only	e F1 position and proceed as in STEP 1A above. e F2 position and tune L301 for min. d-c reading
2	er input terminals. Tune L9 for a maximum
3	NOTE: As the slug is moved into the discrimina- owly through zero and then sharply return through oint.
4	ig. Set the attenuator for 5,000 microvolts and : reading on the meter. *Do not set the frequency rier.
5	mum meter reading. Keep the meter reading
6A	quency standard as a signal source and adjust
6B 2-freq. models only	e F1 position and proceed as in STEP 6A above. e F2 position and adjust L301 for a zero d-c
7	Connect the adapter cable from the voltmeter to lume control for an output voltage of 0.14 v a-c test set this reading should be about 50 ua with ition. Zero the signal generator on the discrim- l the noise reading is reduced to one-tenth of the Read the attenuator scale in microvolts (should 20 db quieting sensitivity.

*CAUTIO ing. This is a
r frequency.

5 kc Pe

(10) Reduce the 1000 cps input
Line" tone deviation should still
may indicate a defective transistor

5. EMERGENCY MEASUREMENT OF DEVIA

If an audio oscillator is not av
be used for a rough measurement
deviation, do so only under control
calibration of the oscilloscope sho
attempt to calibrate the oscilloscop
accurate calibration.

6. OTHER MEANS FOR MEASUREMENT O

Another accurate means of me
quency and Deviation Meter. This
of transmitter deviation from a pe
is not required with this instrumen
accurately even with voice modulat

7. MICROPHONE LEVELS

If the modulation level in the s
above, check the microphone and a

The foregoing procedure will i
maximum deviation.

The importance of the correct
performance demands accurate de
terfere with the user on the adjace

"IDC" ADJUSTMENT (PREFERRED METHOD USING OSCILLOSCOPE)

1. INTRODUCTION

Accuracy of test equipment is of prime importance to any user of radio communications equipment; but of equal importance is a knowledge of the the characteristics of the measuring equipment under various conditions. The Motorola Model T1130A Series FM Station Monitor is the leader in the field with respect to sensitivity, accuracy under conditions of variation in r-f signal level, line voltage, and other environmental conditions. In common with most other meters, however, it has the characteristic of responding differently to different wave shapes. Therefore, the use of most present-day deviation meters can lead to confusion and errors in deviation setting, if the pitfalls are unknown or disregarded.

The "ideal" deviation indicator would be one which would respond instantaneously to the peak value of the modulation deviation, regardless of waveform. The only device which meets all these requirements is an oscilloscope. It responds instantaneously, and it shows the peak value of any waveform, no matter how complex. Properly calibrated, an oscilloscope is the most accurate and reliable means for measuring and setting transmitter deviation.

The oscilloscope must be used in conjunction with a receiver which has a stable discriminator characteristic, since the oscilloscope displays the demodulated signal. In addition to the oscilloscope, a receiver and a means to accurately calibrate the system is required. The Motorola monitors fill these requirements, since they provide both a sensitive receiver with the proper discriminator characteristic and a reliable means of calibrating the oscilloscope. They have convenient terminals on the front panel for connection of the oscilloscope. Furthermore, the Motorola FM Station Monitor is provided with two modulation meter scales, 0-20 kc for wide-band systems, and 0-10 kc for split-channel systems.

Split-channel conversion kits are available for modification of older monitor models, so that they too are provided with convenient oscilloscope terminals and can be more accurate measurement devices for such systems.

2. TEST EQUIPMENT REQUIRED

a. Motorola T1130A Series FM Station Monitor or equivalent.

b. Motorola Transistorized AC Voltmeter or equivalent.

c. Motorola Model TEK-1A Transistorized Tone Generator, 1000 cps or equivalent.

d. Motorola Model T1015A General Purpose Oscilloscope, Motorola Model T1014B Precision Wide-Band Oscilloscope or equivalent.

e. Motorola Model S1056A-9A or TU546 Series Portable Test Set (or equivalent) for use with "Private-Line" models.

3. OSCILLOSCOPE CALIBRATION

The first step in the measurement of transmitter deviation is to calibrate the oscilloscope. This can be done by using the transmitter which is to be measured.

Proceed as follows:

a. Connect the oscilloscope to the monitor oscilloscope terminals, and set up the controls in accordance with the monitor instruction manual.

b. Turn the IDC control on the transmitter chassis to the full clockwise position.

c. Feed a 1000 cps test tone into the base of the amplifier-clipper stage in the IDC circuit. A 0.33 uf capacitor should be placed in series with the tone generator output. Refer to the photograph on the reverse side of this sheet for the location of the 1000 cps test tone injection point. Modulate the transmitter with this tone so adjusted that the deviation as read on the FM monitor deviation meter is 2 kc (6 kc in a wide-band system). An audio oscillator must be used for generation of this tone, since a sinusoidal waveform is very important. The Motorola TEK-1A Transistorized Tone Generator is excellent for this purpose.

d. Adjust the vertical gain of the oscilloscope so that the total recovered audio pattern occupies some convenient height, e.g., four small squares (12 squares in a wide-band system). The split-channel indication is shown in figure 1.

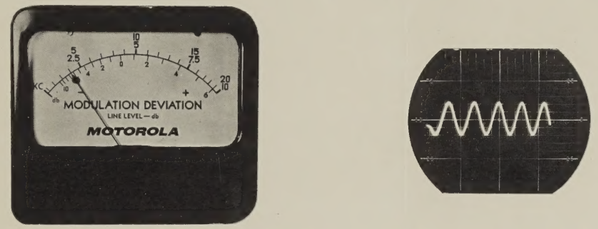


Figure 1.
Oscilloscope Calibration for
Split-Channel Transmitter

Having calibrated the oscilloscope, there is no further need for the modulation deviation meter and its reading should be ignored from this point on. It has already performed its important function of calibrating the oscilloscope.

With the oscilloscope calibrated as indicated, a recovered signal which occupies 10 squares (peak-to-peak) is equivalent to ±5 kc deviation. For wide-band systems, a recovered signal occupying 30 squares (peak-to-peak) is equivalent to ±15 kc deviation.

4. MEASUREMENT AND SETTING OF TRANSMITTER DEVIATION

a. Models for Carrier Squelch Application

Once the oscilloscope has been calibrated the transmitter deviation can be properly adjusted by the following method.

(1) Adjust the 1000 cps input signal to 1.5 volt. This should drive the IDC circuit into full clip. See figure 2.

(2) With this input signal level adjust the IDC control on the transmitter to provide a peak-to-peak recovered signal on the oscilloscope of 10 squares, which is equivalent to ±5 kc deviation as shown in figure 2. A wide-band system should be adjusted for 30 squares (±15 kc). If the waveform under the above conditions does not resemble the waveform shown in figure 2 adjust L101 until a symmetrical waveform is obtained. Re-adjust the IDC control.

(3) Reduce 1000 cps input to 0.25 volt. Essentially full deviation should still be observed on the oscilloscope. Less than 2/3 full deviation will indicate a weak audio transistor or other lack of audio gain.

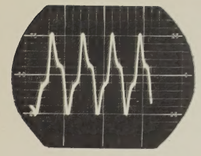


Figure 2.
5 kc Peak Deviation as seen on the Oscilloscope
(NOTE: Waveform is clipped fully)

b. "Private-Line" Models

(1) Remove "Vibrasender-sponder" resonant reed from its socket.

(2) Adjust the 1000 cps input signal to 1.5 volts. This should drive the IDC circuit into full clip. See figure 2.

(3) With this input signal level adjust the IDC control on the transmitter to provide a peak-to-peak recovered signal on the oscilloscope of 10 squares, which is equivalent to ±5 kc deviation as shown in figure 2. If the waveform under the above conditions does not resemble the waveform shown in figure 2, adjust L1 until a symmetrical waveform is obtained. Readjust the IDC control.

(4) Reduce 1000 cps input to 0.25 volt. Essentially full deviation should still be observed on the oscilloscope. Less than full deviation may indicate a weak audio transistor or other lack of audio gain.

(5) Remove the 1000 cps tone signal. Insert the "Vibrasender-sponder" unit in its socket.

(6) Check the "Private-Line" tone deviation. This may be read directly from the oscilloscope by pressing the transmitter push-to-talk switch on the test set. The tone deviation should be 0.5 to 1 kc.

NOTE

If the tone deviation is less than 0.5 kc with jumper JU701 on position 2 (see circuit board diagram), move the jumper to position 3. If the deviation is greater than 1.0 kc, move the jumper to position 1. Always choose the jumper position which produces a tone deviation between 0.5 and 1.0 kc.

Due to a slight increase in discriminator response at the lower frequencies, the oscilloscope will read high, thus, an indication of 1.4 to 2.8 squares (peak-to-peak) is equivalent to 0.5 to 1 kc. This slight variation is only important when checking tone deviation. When setting maximum transmitter deviation as described below, it may be ignored.

(7) Apply a 1000 cps test tone to the base of the amplifier-clipper stage Q111. Place a 0.33 uf capacitor in series with the tone generator output.

(8) Adjust the 1000 cps input signal level for 1 volt and note the resultant combined deviation of the 1000 cps modulation and tone signal modulation on the oscilloscope.

(9) The IDC control on the transmitter should be adjusted to provide a peak-to-peak combined signal of 10 squares, equivalent to full 5 kc as shown in figure 3.

AEPD-4555-O(p/o CE1840)
AEPD-4554-O(p/o CE1840)
AEPD-4597-O(p/o CE1840)

TEST EQUIPMENT REQUIRED FOR RECEIVER ALIGNMENT

1. Motorola DC Multimeter or equivalent.
2. Motorola Transistorized AC Voltmeter or equivalent.
3. Motorola T1034B Signal Generator or equivalent.
4. Motorola S1056A-9A or TU546 Series Test Set with 455 kc crystal or equivalent crystal-controlled oscillator.
5. Motorola TEKA-37 Audio Metering Adapter Cable used with the test set.
6. Motorola NEN6035A Test Jig.
7. Motorola NLN6245A Alignment Tool (supplied).

TEKA-37 AUDIO METERING ADAPTER CABLE

The TEKA-37 Audio Metering Adapter Cable allows the Motorola test set to measure the 20 db quieting audio levels and the audio power output levels at the receiver external speaker jack (J2). One end of the cable plugs into the microphone connector of the test set and the other end is plugged into the receiver speaker jack of the radiophone.

HOW TO SET UP THE S1056A-9A OR TU546 SERIES TEST SETS

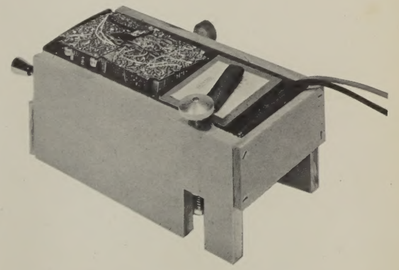
1. Set the function selector switch to the XMTR position.
2. Plug the test set metering cable into the 20-pin receptacle on the test set.
3. Turn the meter switch to position 11 (AUDIO).
4. Plug the TEKA-37 Audio Metering Adapter Cable into the microphone receptacle on the test set. Plug the other end of the adapter cable into the external speaker jack (J2). Place the multiplier switch in the 0.2 v a-c position to increase the meter sensitivity 10 times.
5. The rated audio output, 500 mw, is equal to a reading of 31 ua with the meter multiplier switch in the 2.0 v a-c position.

FREQUENCY CALCULATIONS

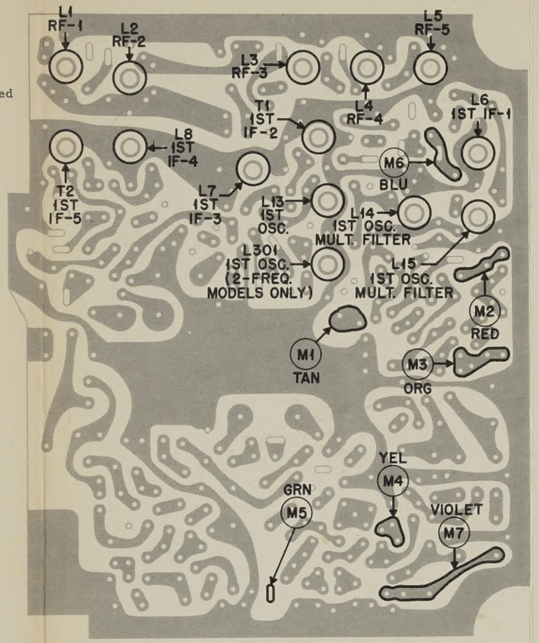
$$f_{01} = \frac{f_c - f_1}{3}$$

where: f_{01} = 1st oscillator frequency;
f_c = carrier frequency;
f_1 = high intermediate frequency (11.7 mc);
f_{02} = 2nd oscillator crystal frequency.

Carrier Freq. (MC) F_c	2nd Osc. Xtal Freq. (MC) F_{02}
132.00 -134.00	11.245
134.001-136.0	12.155
136.001-145.0	11.245
145.001-145.50	12.155
145.501-146.00	11.245
146.001-150.80	12.155
150.801-157.0	11.245
157.001-157.60	12.155
157.601-168.00	11.245
168.001-169.0	12.155
169.001-174.0	11.245



RADIOPHONE IN TEST JIG



METERING AND ALIGNMENT POINTS

ALIGNMENT PROCEDURE

NOTES

1. All slugs should be tuned to the peak nearest the printed circuit board end of the coil.
2. Turn on the radiophone, set the squelch control for maximum noise and place it in the Motorola NEN6035A Test Jig with the speaker grill face down. Open the back cover as shown in paragraph 4 in the MAINTENANCE section.
3. A Motorola S1056A-9A or TU546 Series Test Set, with a TEKA-37 Audio Metering Adapter Cable may be used in place of the a-c voltmeter, or the d-c multimeter.
4. When using an a-c voltmeter for the 20 db quieting sensitivity measurement, a 15 ohm, 1/2 watt resistor must be placed in parallel with the test leads from the voltmeter to the external speaker jack (J2).

STEP	TEST EQUIPMENT	METER POINT & COLOR CODE	ADJUSTMENT	PROCEDURE
1A	DC multimeter	M-6 (BLU)	L13 1st Osc (F1) L14 Mult. Filter L15 Mult. Filter	Tune L13, L14 and L15 for min. d-c reading on the meter.
1B 2-freq. models only	DC multimeter	M-6 (BLU)	L301 1st Osc (F2)	Place the frequency selector switch in the F1 position and proceed as in STEP 1A above. Place the frequency selector switch in the F2 position and tune L301 for min. d-c reading on the meter.
2	DC multimeter and 455 kc crystal osc	M-7 (VIO)	L9 Limiter	Couple a 455 kc signal into the 455 kc filter input terminals. Tune L9 for a maximum positive d-c reading.
3	DC multimeter and 455 kc crystal osc	M-4 (YEL)	L10 Disc.	Tune L10 for a zero d-c meter reading. NOTE: As the slug is moved into the discriminator coil, the meter reading may move slowly through zero and then sharply return through zero again. Tune the slug to the latter point.
4	T1034B Signal Generator and d-c multimeter	M-4 (YEL)	Signal Generator to carrier frequency	Connect the signal generator to the test jig. Set the attenuator for 5,000 microvolts and adjust the signal frequency for a zero d-c reading on the meter. *Do not set the frequency to the 2nd i-f image 910 kc below the carrier.
5	T1034B Signal Generator and a-c voltmeter	M-1 (TAN)	T2, L8, L7, T1, L6, L5, L4, L3, L2, L1	Tune these slugs successively for a maximum meter reading. Keep the meter reading below -20 dbm on the a-c voltmeter.
6A	DC multimeter	M-4 (YEL)	L13 1st Osc	Use the base station transmitter or a frequency standard as a signal source and adjust L13 for a zero d-c reading.
6B 2-freq. models only	DC multimeter	M-4 (YEL)	L301 1st Osc (F2)	Place the frequency selector switch in the F1 position and proceed as in STEP 6A above. Place the frequency selector switch in the F2 position and adjust L301 for a zero d-c reading.
7	T1034B Signal Generator and a-c voltmeter with adapter cable (see NOTE 4) or T1034B Signal Generator and S1056A-9A or TU546 Series Test Set with TEKA-37 Audio Metering Adapter Cable	External Speaker Jack (M-8)	Signal Generator	Set squelch control for maximum noise. Connect the adapter cable from the voltmeter to the external speaker jack. Adjust the volume control for an output voltage of 0.14 v a-c (noise only - no signal input). Using the test set this reading should be about 50 ua with the multiplier switch in the 0.2 v a-c position. Zero the signal generator on the discriminator. Increase the signal intensity until the noise reading is reduced to one-tenth of the reading with no signal (maximum noise). Read the attenuator scale in microvolts (should be less than 0.5 microvolts). This is the 20 db quieting sensitivity.

*CAUTION: After adjusting the signal generator to the carrier, look for the image frequency at 910 kc below this setting. This is a check on the accuracy of the setting. Upon locating the image, return to the proper setting for the carrier frequency.

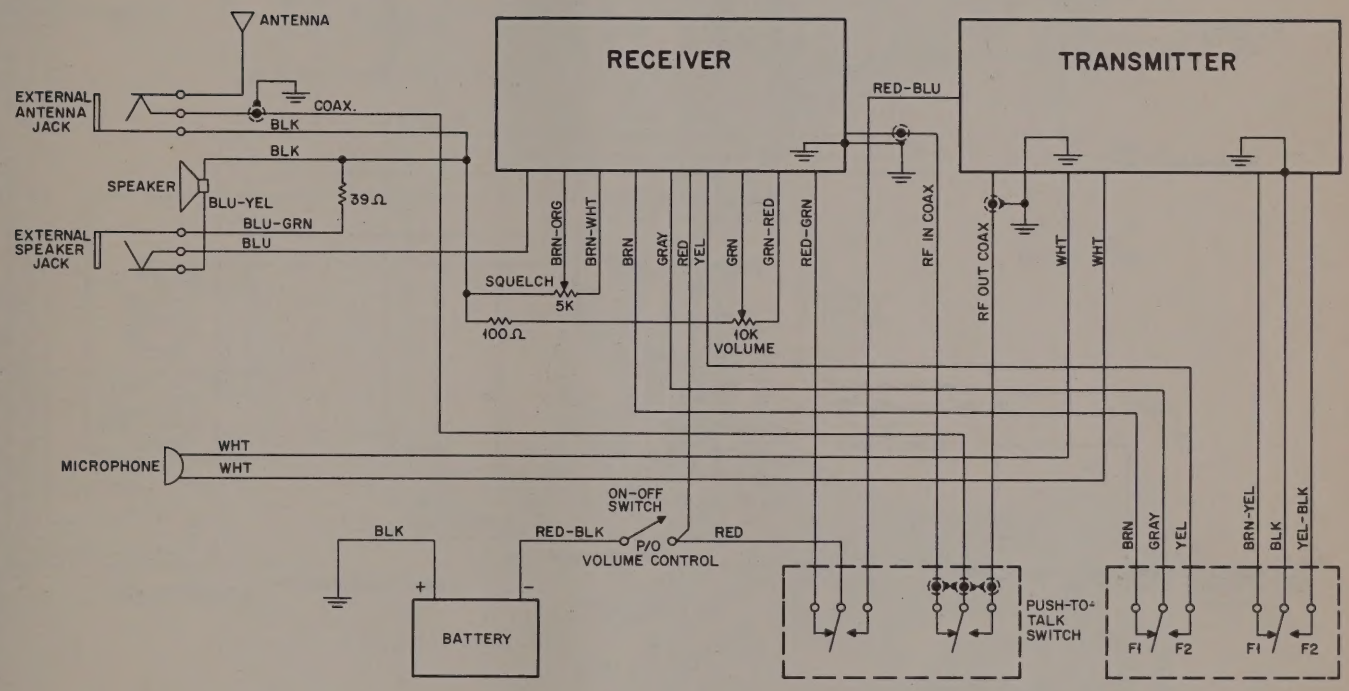
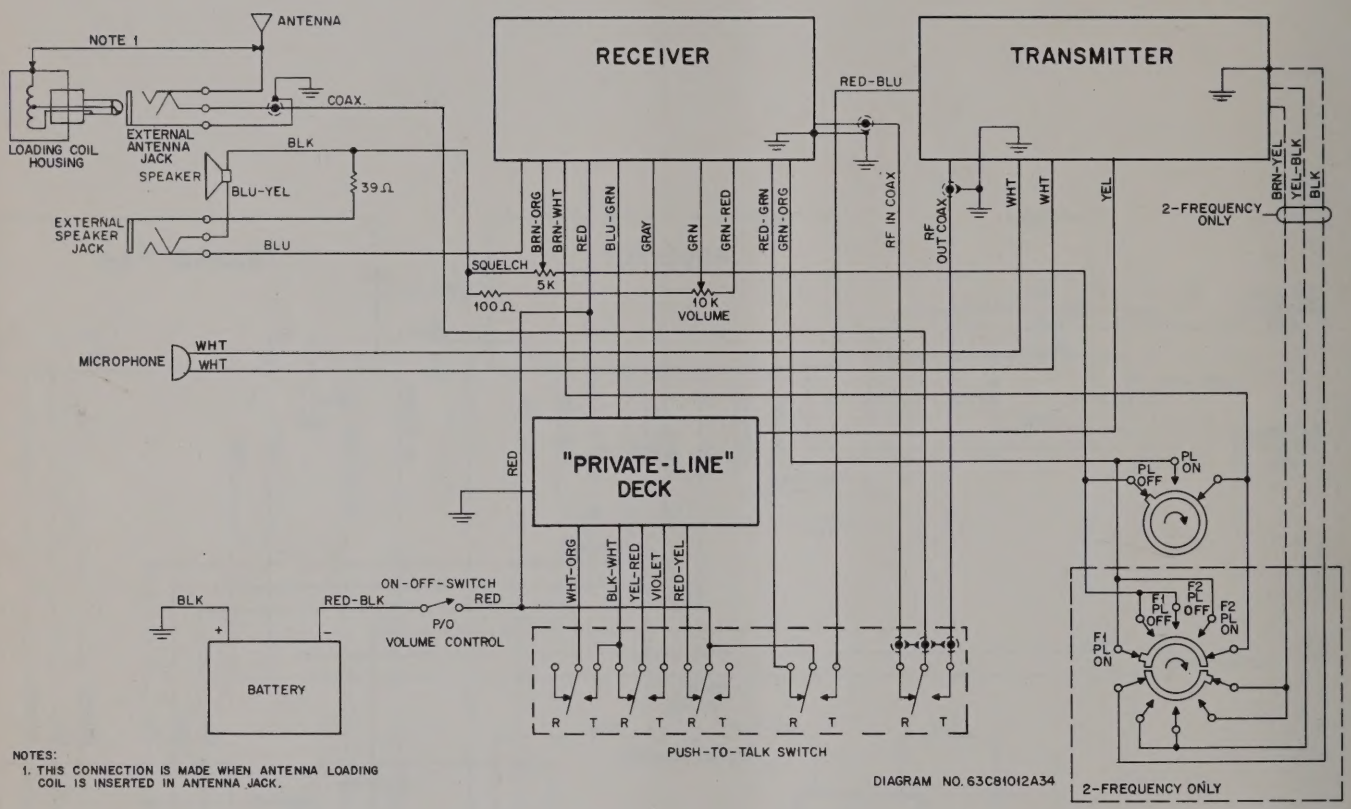


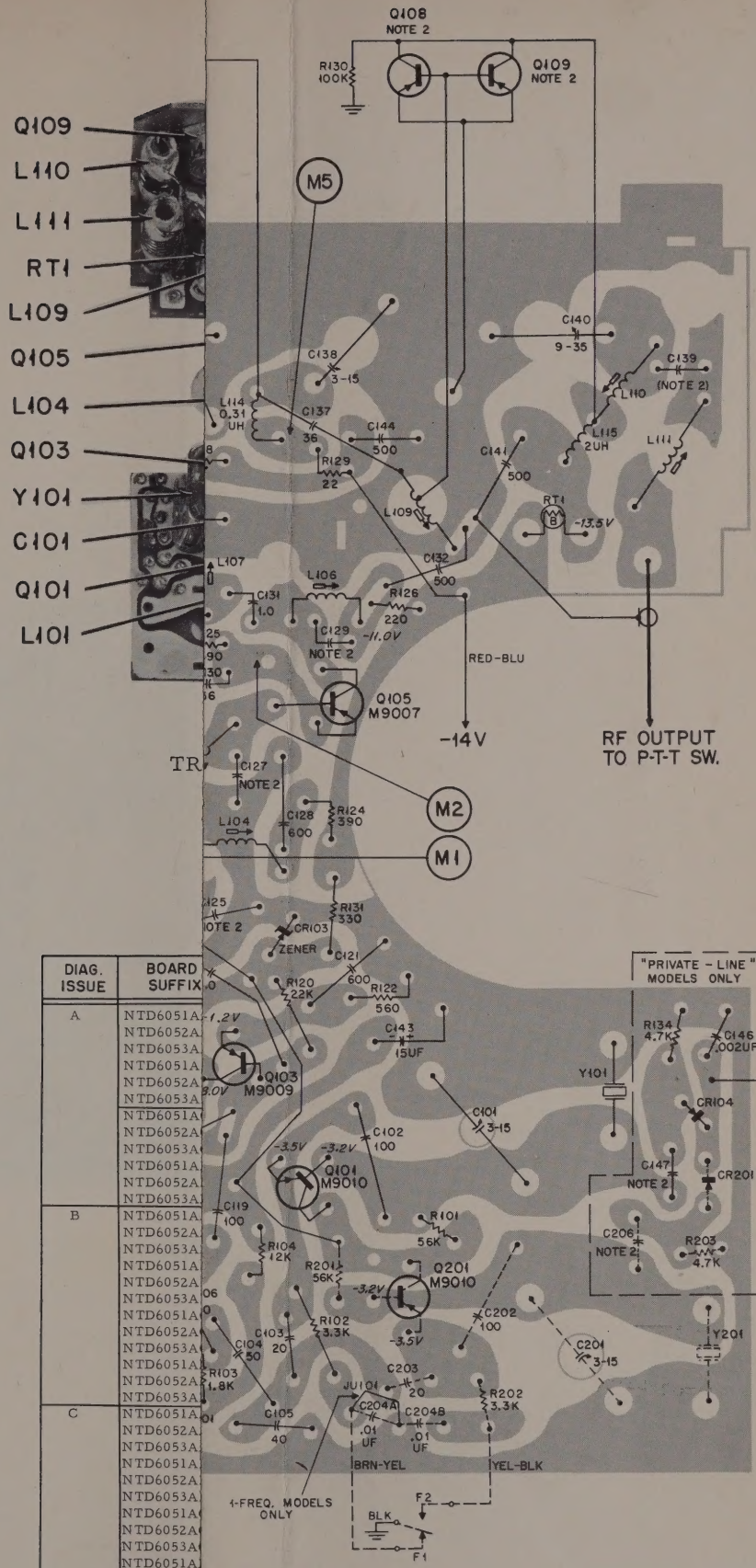
DIAGRAM NO. 63C81012A31

H23DCN-1000 Series
Intercabling Diagram
Motorola No. 63C81012A31-A



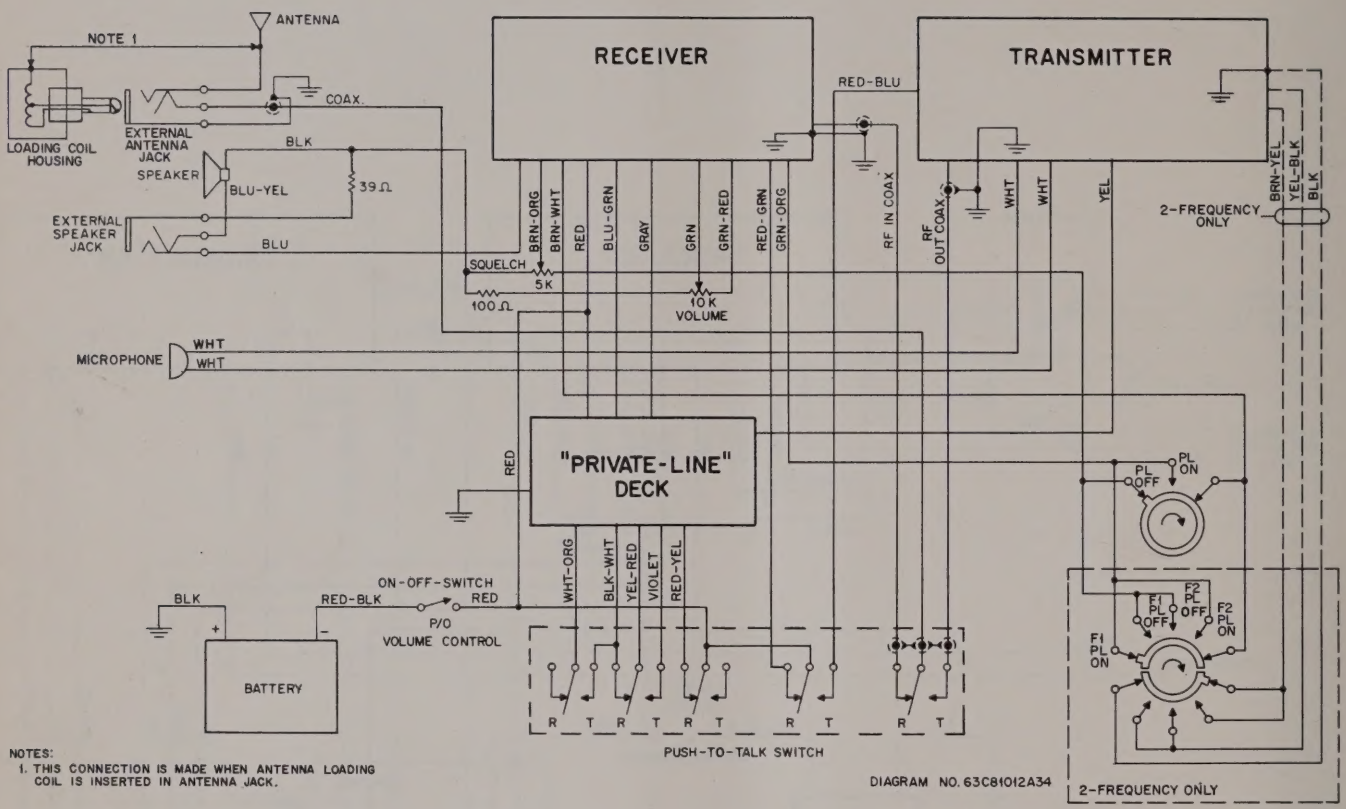
NOTES:
1. THIS CONNECTION IS MADE WHEN ANTENNA LOADING COIL IS INSERTED IN ANTENNA JACK.

H23DCN-3000 Series
Intercabling Diagram
Motorola No. 63C81012A34-B



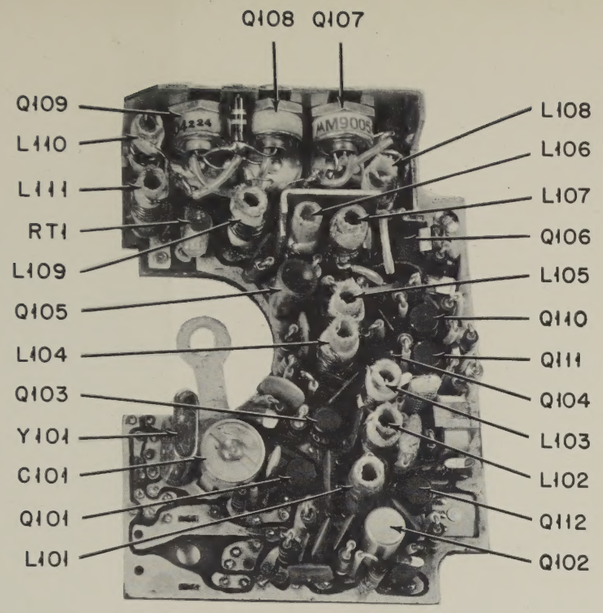
DIAG. ISSUE	BOARD SUFFIX
A	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
B	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
C	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A
D	NTD6051A
	NTD6052A
	NTD6053A
	NTD6051A
	NTD6052A
	NTD6053A

Transmitter Printed Circuit Board and Wiring Diagram Motorola No. EPD-7929-D



NOTES:
1. THIS CONNECTION IS MADE WHEN ANTENNA LOADING COIL IS INSERTED IN ANTENNA JACK.

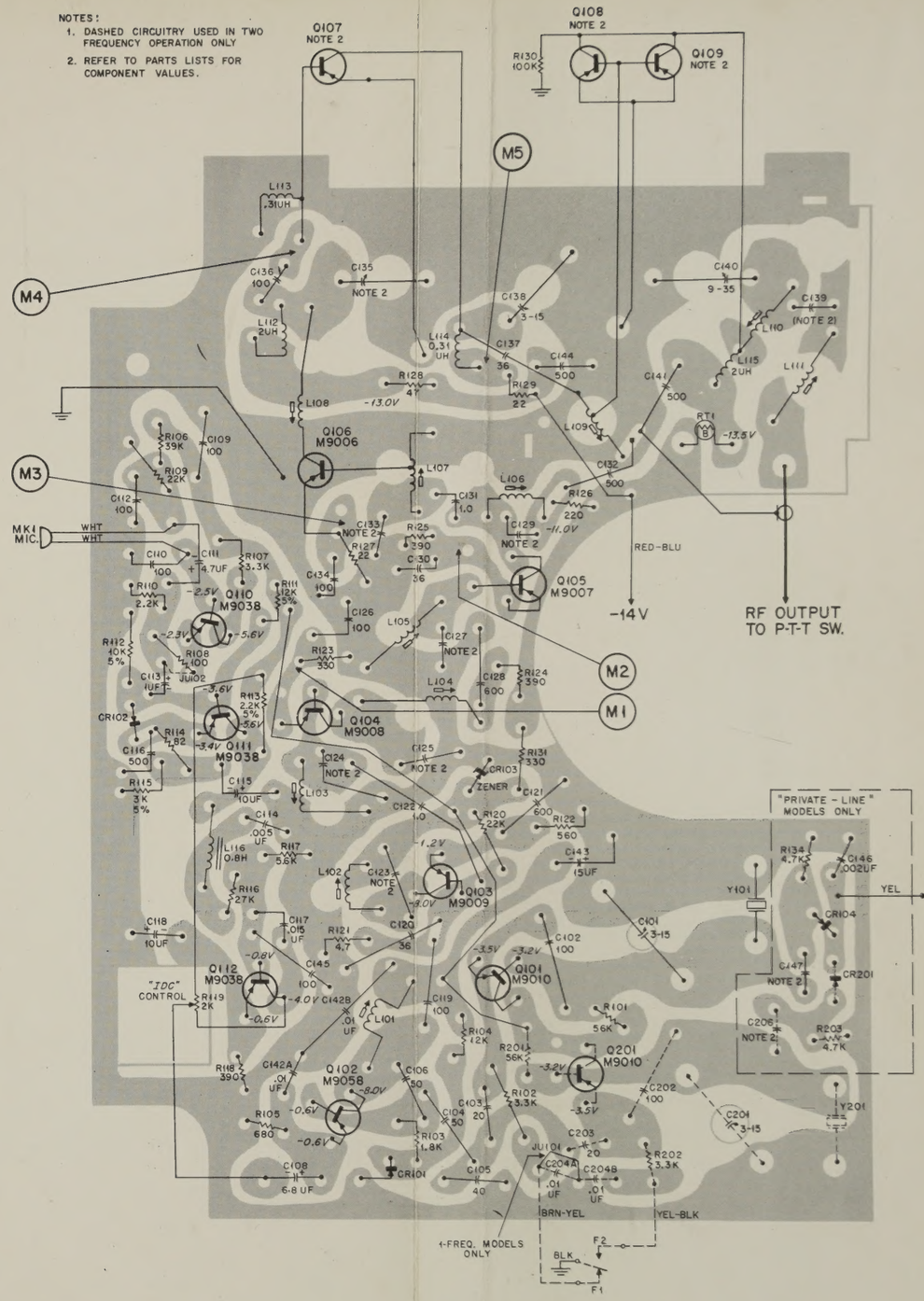
H23DCN-3000 Series
Intercabling Diagram
Motorola No. 63C81012A34-B



TRANSMITTER PRINTED
CIRCUIT BOARD

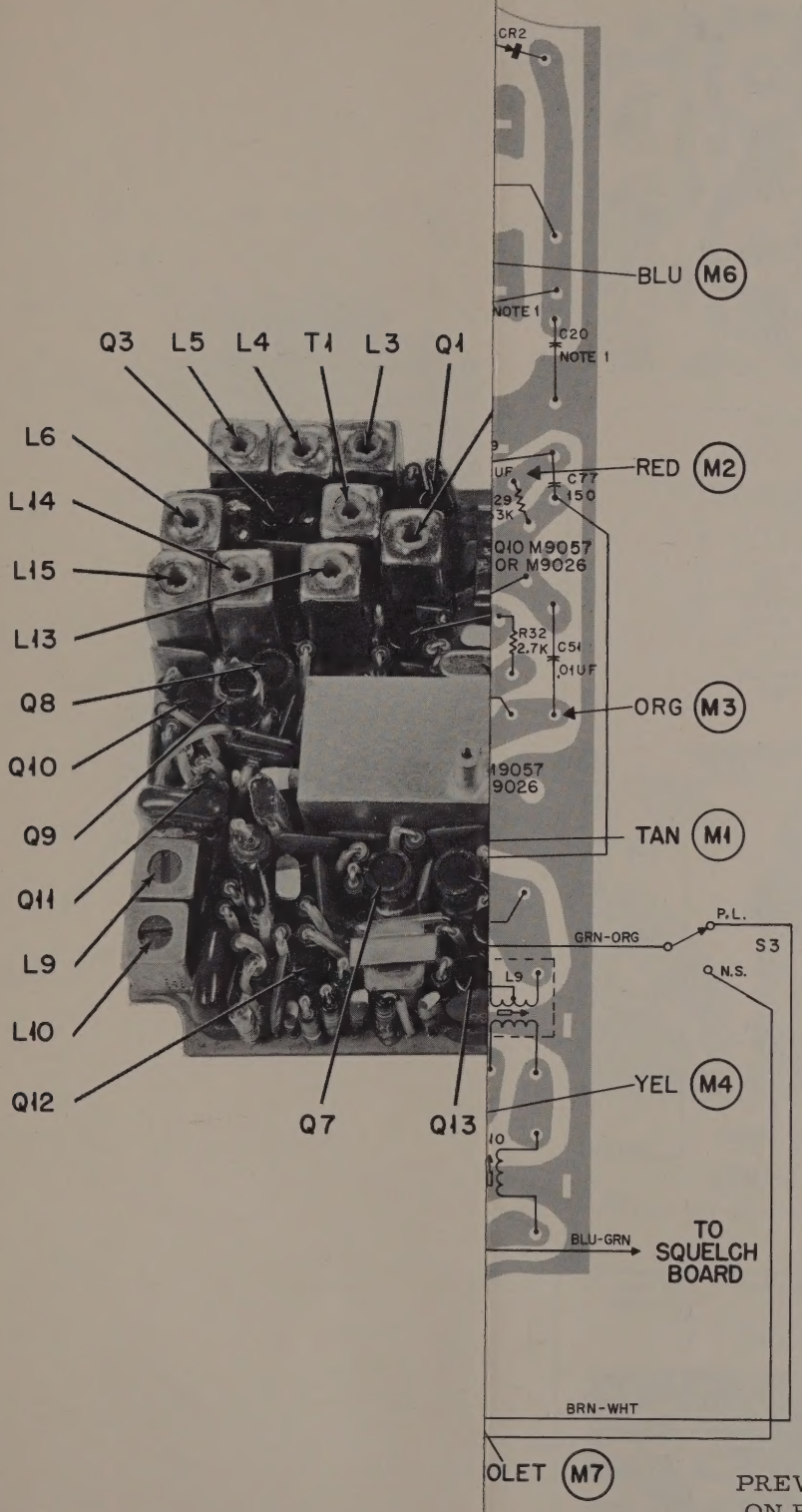
REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NTD6051AA	C120	WAS 21K861435 (70 uuf)	Q103 BASE
	NTD6052AA-1 NTD6053AA-1 NTD6051AB NTD6052AB-1 NTD6053AB-1	C143	WAS 21K847053	PARTS LIST
	NTD6051AC NTD6052AC NTD6053AC NTD6051AD NTD6052AD NTD6053AD		ADDED "PRIVATE-LINE" CIRCUITRY	LOWER RIGHT-HAND CORNER
B	NTD6051AA NTD6052AA-2 NTD6053AA-2 NTD6051AB NTD6052AB-2 NTD6053AB-2 NTD6051AC NTD6052AC-1 NTD6053AC-1 NTD6051AD NTD6052AD-1 NTD6053AD-1	C138	WAS 20C82399D06	Q107 BASE
C	NTD6051AA NTD6052AA-3 NTD6053AA-3 NTD6051AB NTD6052AB-3 NTD6053AB-3 NTD6051AC NTD6052AC-2 NTD6053AC-2 NTD6051AD NTD6052AD-2 NTD6053AD-2	C137L	WAS 21K865197 (25 uuf)	Q107 COLLECTOR
		L113	WAS 24C82000E07 (2 uh)	Q107 BASE
		C141L	WAS 21K861443 (.01 uf)	UPPER RIGHT OF BOARD
		Q107	COLLECTOR VOLTAGE WAS -11.8 V	UPPER LEFT OF BOARD
D	NTD6051AC-1 NTD6052AC-3 NTD6053AC-3 NTD6051AD-1 NTD6052AD-3 NTD6053AD-3	C147 & C206	WAS 21K861429, 8 uuf	"PRIVATE-LINE" CIRCUIT ONLY



Transmitter Printed Circuit
Board and Wiring Diagram
Motorola No. EPD-7929-D

DEPD-7594-C EEPD-7595-E AEPD-8000-O (p/o MC7838)

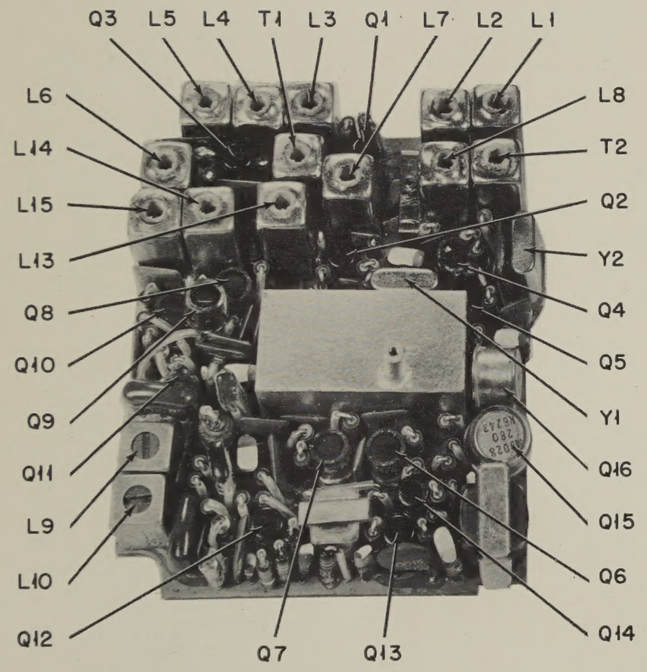


MODEL	SUFFIX
NRD1131AA	1
NRD1132AA	4
NRD1131AB	1
NRD1132AB	4
NRD1131AF	1
NRD1132AF	1

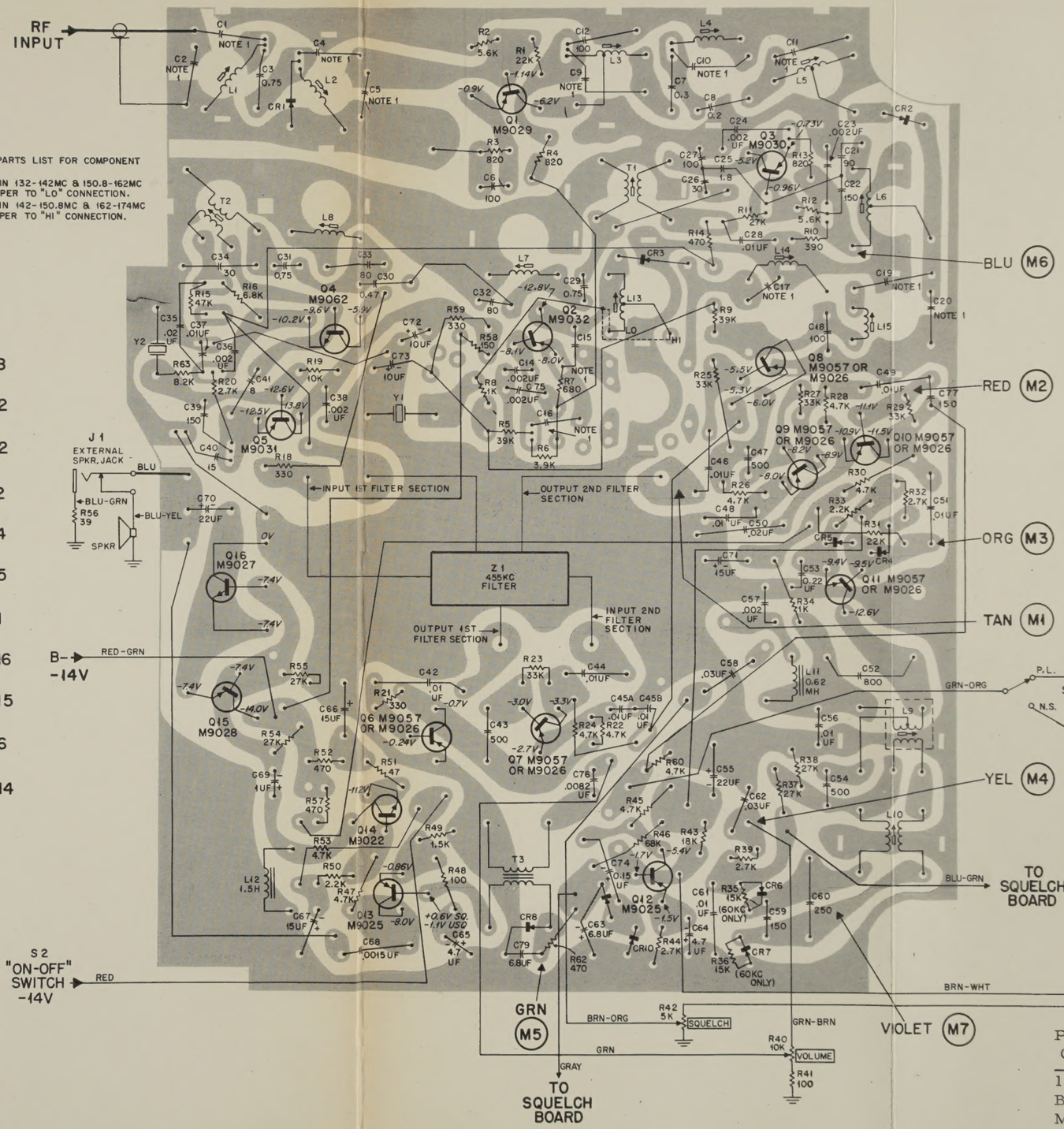
FOR RECEIVERS SUFFIXED LATER THAN INDICATED IN THIS CHART, REFER TO EPD-8456

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

1-Frequency Receiver Printed Circuit Board and Wiring Diagram Motorola No. EPD-7930-C1



NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142MC & 150.8-162MC RANGE, JUMPER TO "LO" CONNECTION.
   FOR UNITS IN 142-150.8MC & 162-174MC RANGE, JUMPER TO "HI" CONNECTION.



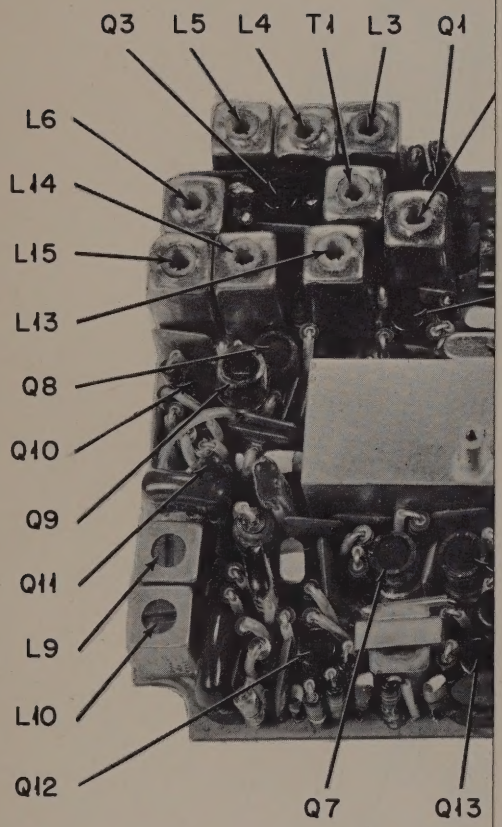
MODEL	SUFFIX
NRD1131AA	1
NRD1132AA	4
NRD1131AB	1
NRD1132AB	4
NRD1131AF	1
NRD1132AF	1

FOR RECEIVERS SUFFIXED LATER THAN INDICATED IN THIS CHART, REFER TO EPD-8456

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

1-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-7930-C1

DEPD-8454-O EEPD-8455-O AEPD-8000-O (p/o MC7838)



NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142 & 150.8-162MC RANGE JUMPER TO "LO" CONNECTION.
   FOR UNITS IN 142-150.8 & 162-174MC RANGE JUMPER TO "HI" CONNECTION.
3. PART OF HOUSING KIT.

MODEL CHART

MODEL	SUFFIX
NRD1131AC	2
NRD1132AC	3
NRD1131AD	2
NRD1132AD	3

FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-8142.

MODEL	SUFFIX
NRD1131AA	2
NRD1132AA	5
NRD1131AB	2
NRD1132AB	5
NRD1131AF	2
NRD1132AF	2

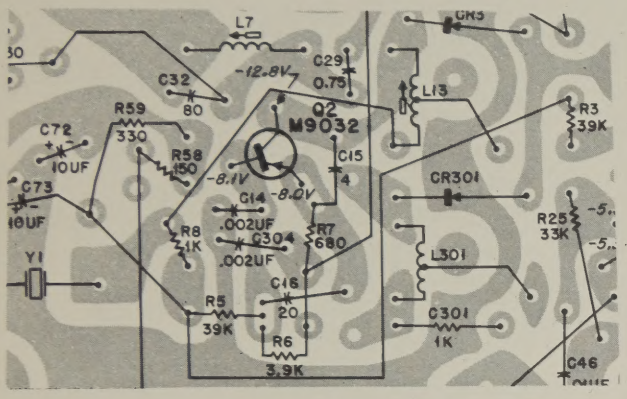
FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-7930

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

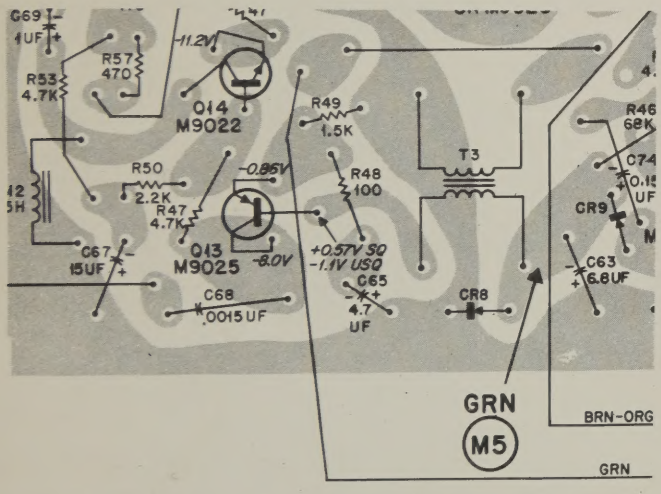
1-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8456-O

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1132AA-1 NRD1132AB-1	Q4	WAS TYPE M9054	2ND MIXER
		C75	WAS REF. C304	Q2
		R9	WAS REF. R3	
			REMOVED 2-FREQ. CIRCUITRY, CIRCUIT WAS AS SHOWN BELOW	



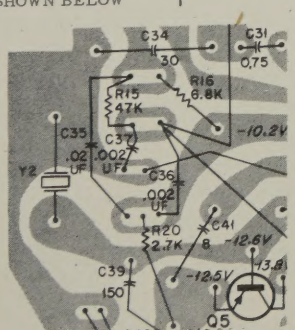
	JUMPER ADDED BETWEEN JUNCTIONS R3, C6, AND L2, C5, CR1	Q1
CR11	ADDED 48C82363E02	Q14
R53	RELOCATED 6K127804 (4.7K)	
	RELOCATED GRN LEAD OF R40 VOLUME CONTROL	
	ADDED RED-YEL LEAD BETWEEN "ON-OFF" SWITCH AND R53 (4.7K) CIRCUIT WAS AS SHOWN BELOW	

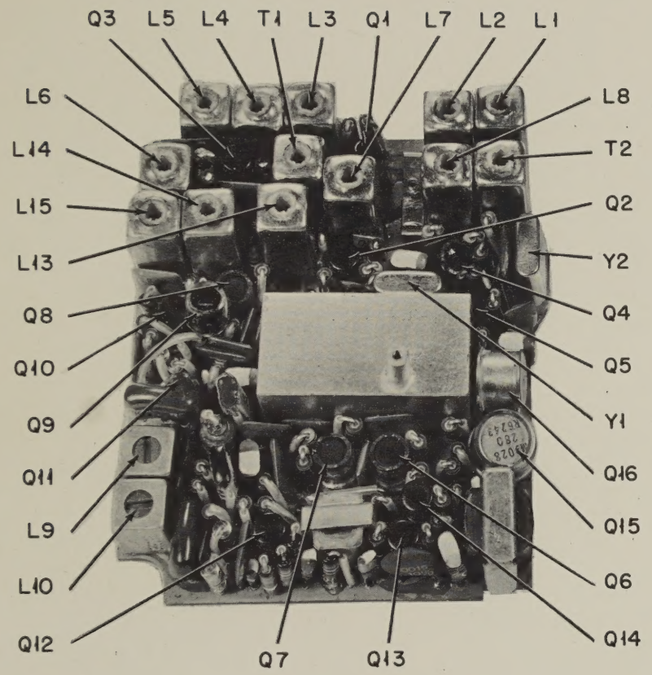


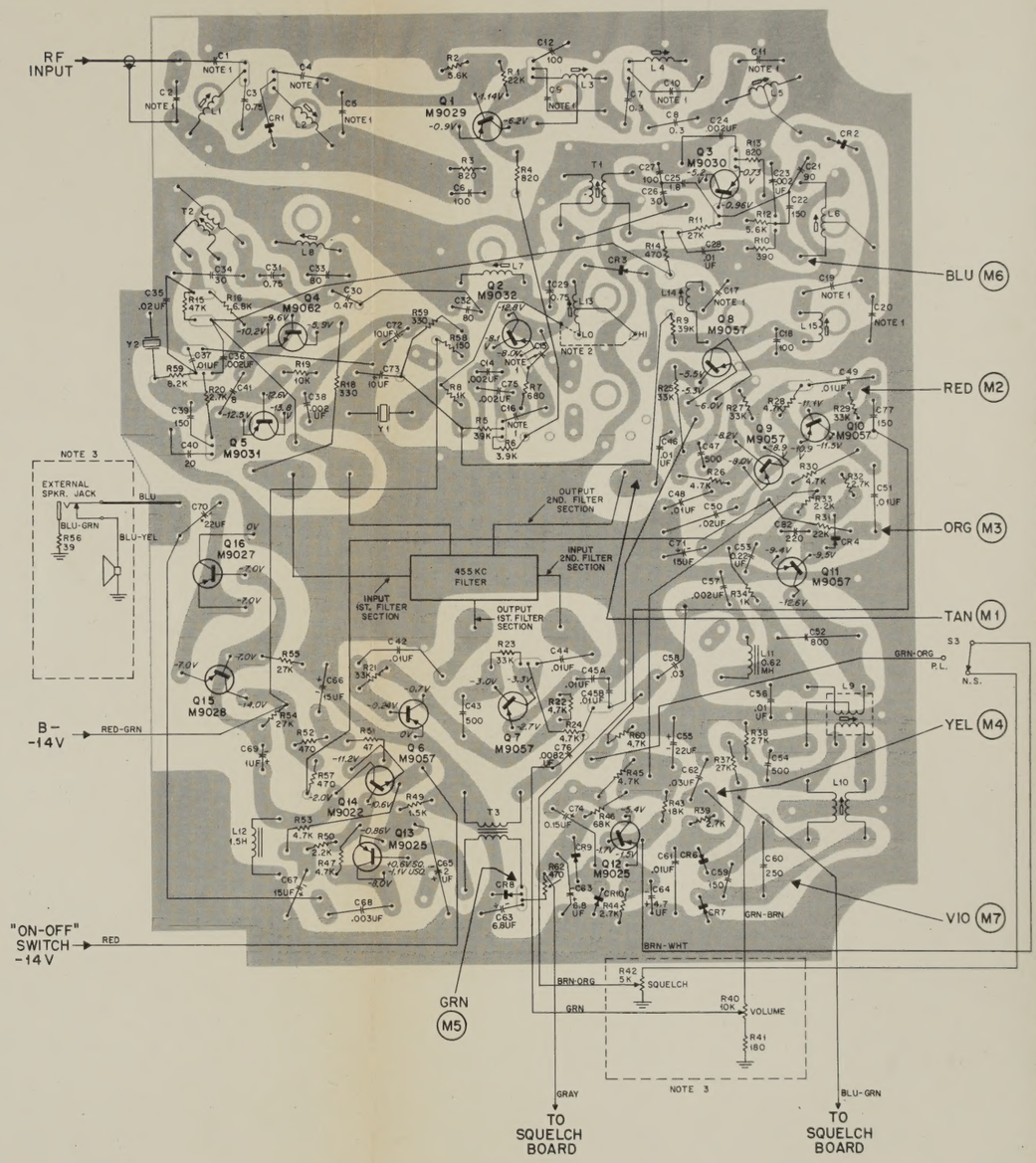
REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
C	NRD1131AA-1 NRD1132AA-4 NRD1131AB-1 NRD1132AB-4 NRD1131AF-1 NRD1132AF-1	CR11	REMOVED 48C82363E02	Q14 BASE, EMITTER
C1			PRINTED CIRCUIT BOARD COMPLETELY REVISED	REFER TO EPD-8456 FOR LATER SUFFIXED MODELS

B	NRD1131AA NRD1132AA-3 NRD1131AB NRD1132AB-3	R59	ADDED 6K128560 (8.2K) CIRCUIT WAS AS SHOWN BELOW	Q5 BASE 2ND OSC.







NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142 & 150.8-162MC RANGE JUMPER TO "LO" CONNECTION.
   FOR UNITS IN 142-150.8 & 162-174MC RANGE JUMPER TO "HI" CONNECTION.
3. PART OF HOUSING KIT.

MODEL CHART

MODEL	SUFFIX
NRD1131AC	2
NRD1132AC	3
NRD1131AD	2
NRD1132AD	3

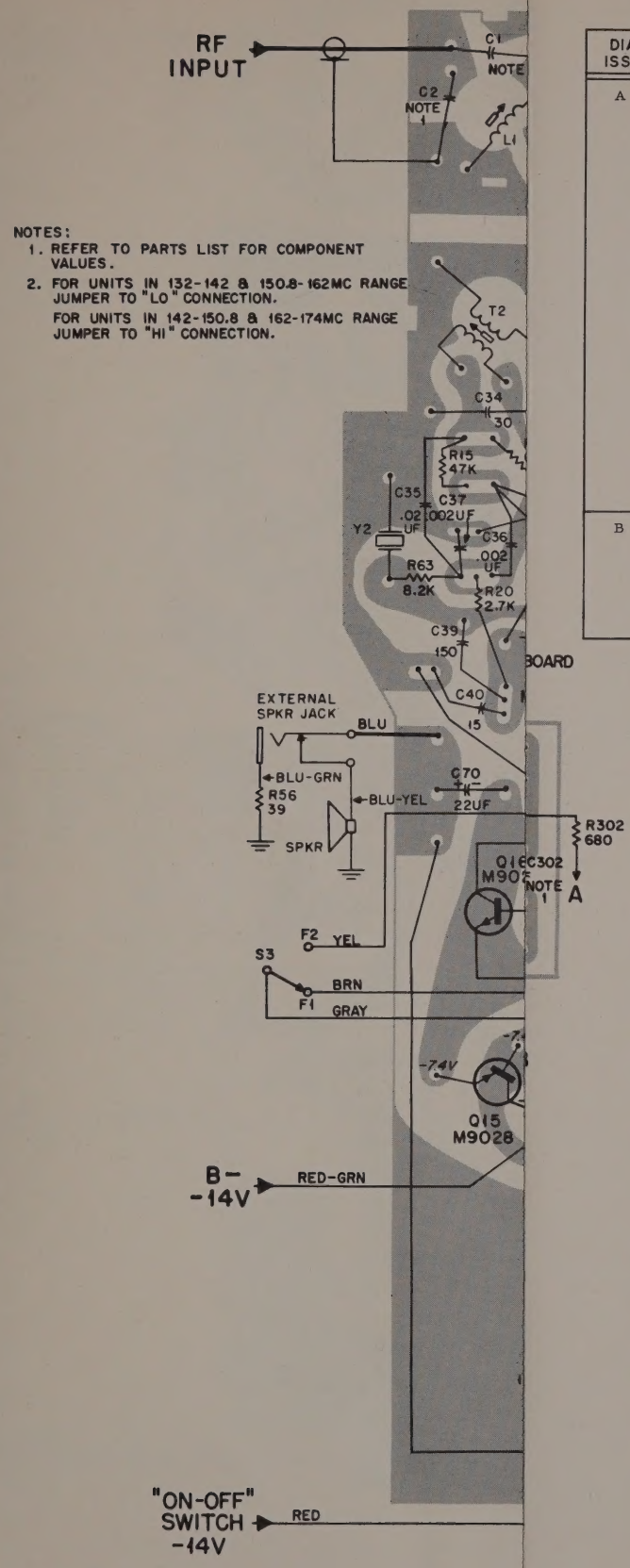
FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-8142.

MODEL	SUFFIX
NRD1131AA	2
NRD1132AA	5
NRD1131AB	2
NRD1132AB	5
NRD1131AF	2
NRD1132AF	2

FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-7930

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

1-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8456-O

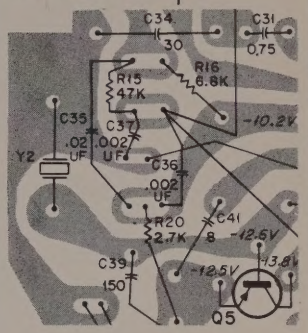


NOTES:

1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142 & 150.8-162MC RANGE JUMPER TO "LO" CONNECTION.
   FOR UNITS IN 142-150.8 & 162-174MC RANGE JUMPER TO "HI" CONNECTION.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1131AC NRD1132AC-1 NRD1131AD NRD1132AD-1	R59	ADDED 6K128560 (8.2K) CIRCUIT WAS AS SHOWN BELOW	Q5 BASE 2ND OSC.
B	NRD1131AC-1 NRD1132AC-2 NRD1131AD-1 NRD1132AD-2	CR11	REMOVED 48C82363E02	Q14 BASE, EMITTER
			PRINTED CIRCUIT BOARD COMPLETELY REVISED	REFER TO EPD-8453 FOR LATER SUFFIXED MODELS



MODEL	SUFFIX
NRD1131AC	1
NRD1132AC	2
NRD1131AD	1
NRD1132AD	2

FOR RECEIVERS SUFFIXED LATER THAN INDICATED IN THIS CHART, REFER TO EPD-8453

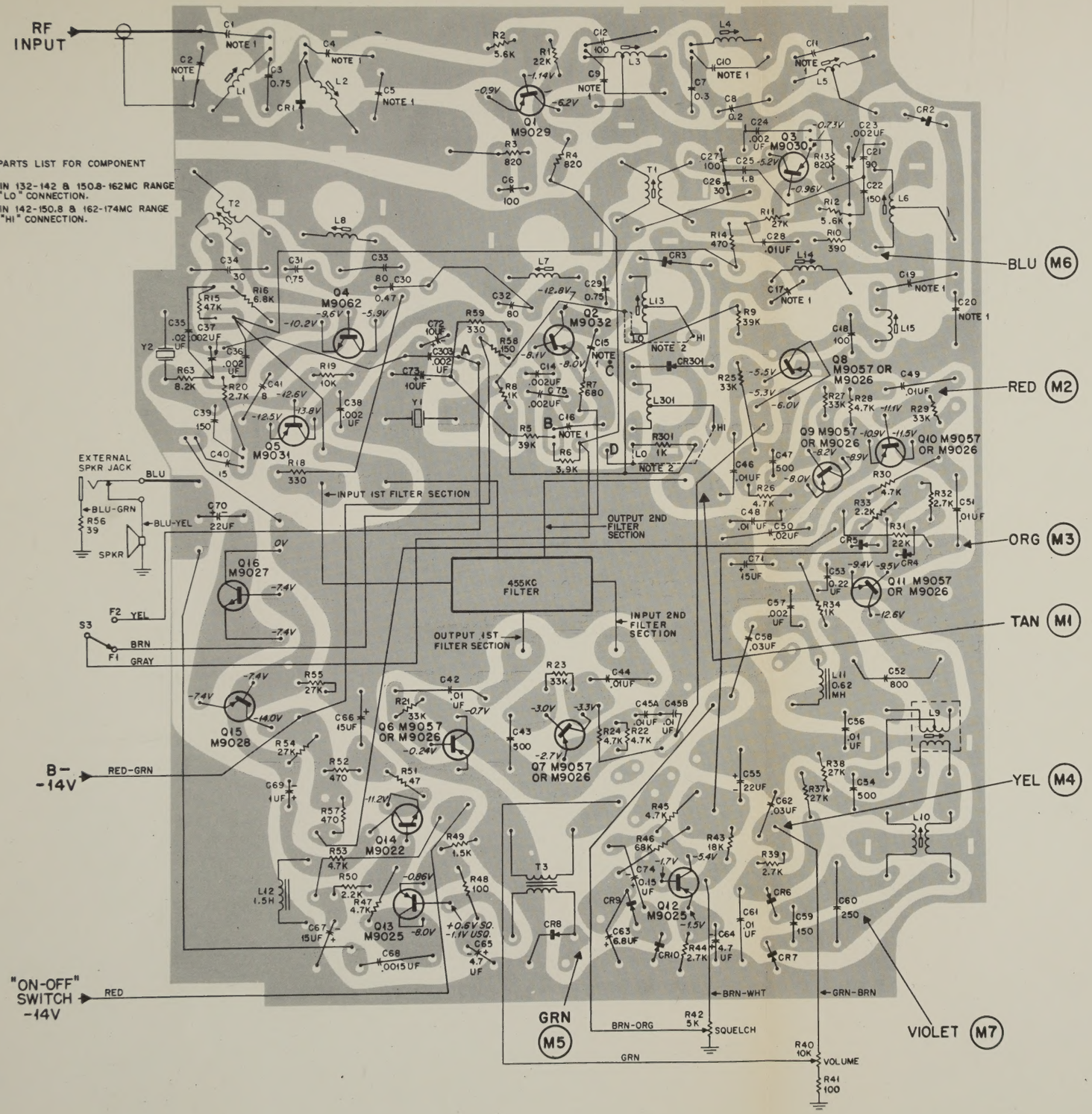
EEPD-8141-C

EEPD-8140-C

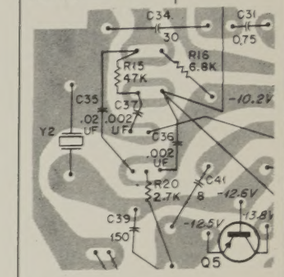
2-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8142-B

REVISIONS

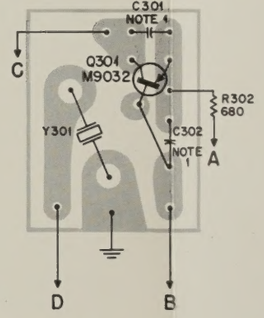
DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
WAS EPD-7930	NRD1131AA-2 NRD1132AA-5	C8	WAS 21C82450B25 (0.2 uf)	ABOVE Q3
	NRD1131AB-2 NRD1132AB-5	C37	WAS 21K861442 (.002 uf)	LEFT OF Q4
	NRD1131AF-2 NRD1132AF-2	C79	ADDED 23C82397D09 (6.8 uf)	LEFT OF Q12
		R62	ADDED 6K128545 (470)	
		CR8, 9, 10	WERE 48C82363E02	PARTS LIST
		R61	ADDED 6K128557 (4.7K)	Q10 BASE
	NRD1131AF-2 NRD1132AF-2	T3	WAS 25B82699D01	PARTS LIST
	NRD1131AA-3 NRD1132AA-6	CR5	REMOVED 48C82178A01 (30 KC)	Q11 BASE-EMITTER
		C82	ADDED 21K868829 (220 uuf) (30 KC)	
		C81	ADDED 21K864013 (60 KC)	Q9 BASE
		C83	ADDED 21K847065 (5000 uuf) (60 KC)	ABOVE Q12
		R61	REMOVED 6K128557 (4.7K)	Q10 BASE
	NRD1131AA-4 NRD1132AA-7 NRD1131AB-3 NRD1132AB-6 NRD1131AF-3 NRD1132AF-3	CR5	REMOVED 48C82178A01 (30 KC)	Q11 BASE-EMITTER
		C82	ADDED 21K868829 (220 uuf) (30 KC)	
	NRD1131AA-5 NRD1132AA-8 NRD1131AB-4 NRD1132AB-7 NRD1131AF-4 NRD1132AF-4	C40	WAS 21K861462 (15 uuf)	Q5 EMITTER
		Q15, 16	BASE & EMITTER VOLTAGES WERE -7.4 V	
	NRD1131AA-6 NRD1132AA-9 NRD1131AB-5 NRD1132AB-8 NRD1131AF-5 NRD1132AF-5	C65	WAS 23C82397D05 (4.7 uf)	RIGHT OF Q13
		R48	REMOVED 6K129753 (100)	
		C68	WAS 21C82187B11 (1500 uuf)	
	NHN6068A-1 NHN6070A-1 NHN6074A-1 NHN6078A-1 NHN6080A-1	R41	WAS 6K129753 (100)	LOWER RIGHT OF BOARD



REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1131AC NRD1132AC-1 NRD1131AD NRD1132AD-1	R59	ADDED 6K128560 (8.2K) CIRCUIT WAS AS SHOWN BELOW 	Q5 BASE 2ND OSC.
B	NRD1131AC-1 NRD1132AC-2 NRD1131AD-1 NRD1132AD-2	CR11	REMOVED 48C82363E02	Q14 BASE, EMITTER
			PRINTED CIRCUIT BOARD COMPLETELY REVISED	REFER TO EPD-8453 FOR LATER SUFFIXED MODELS

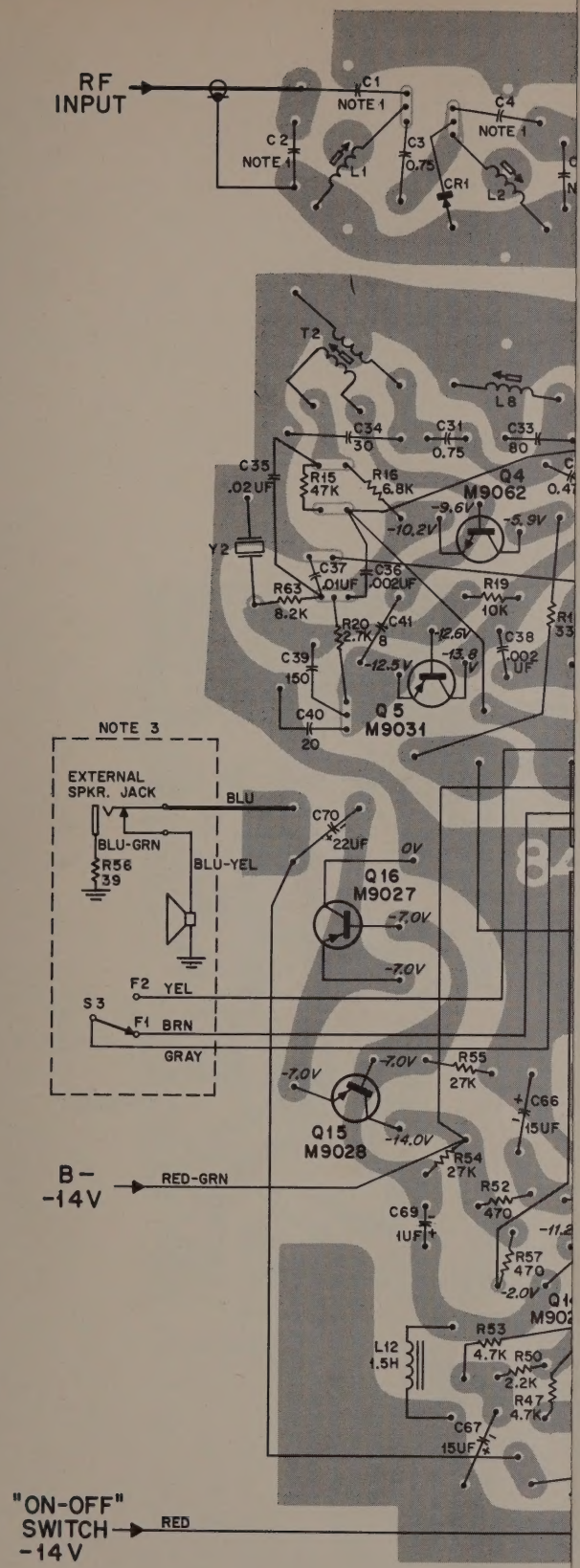
1ST OSC. CIRCUIT BOARD F2



MODEL	SUFFIX
NRD1131AC	1
NRD1132AC	2
NRD1131AD	1
NRD1132AD	2

FOR RECEIVERS SUFFIXED LATER THAN INDICATED IN THIS CHART, REFER TO EPD-8453

2-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8142-B



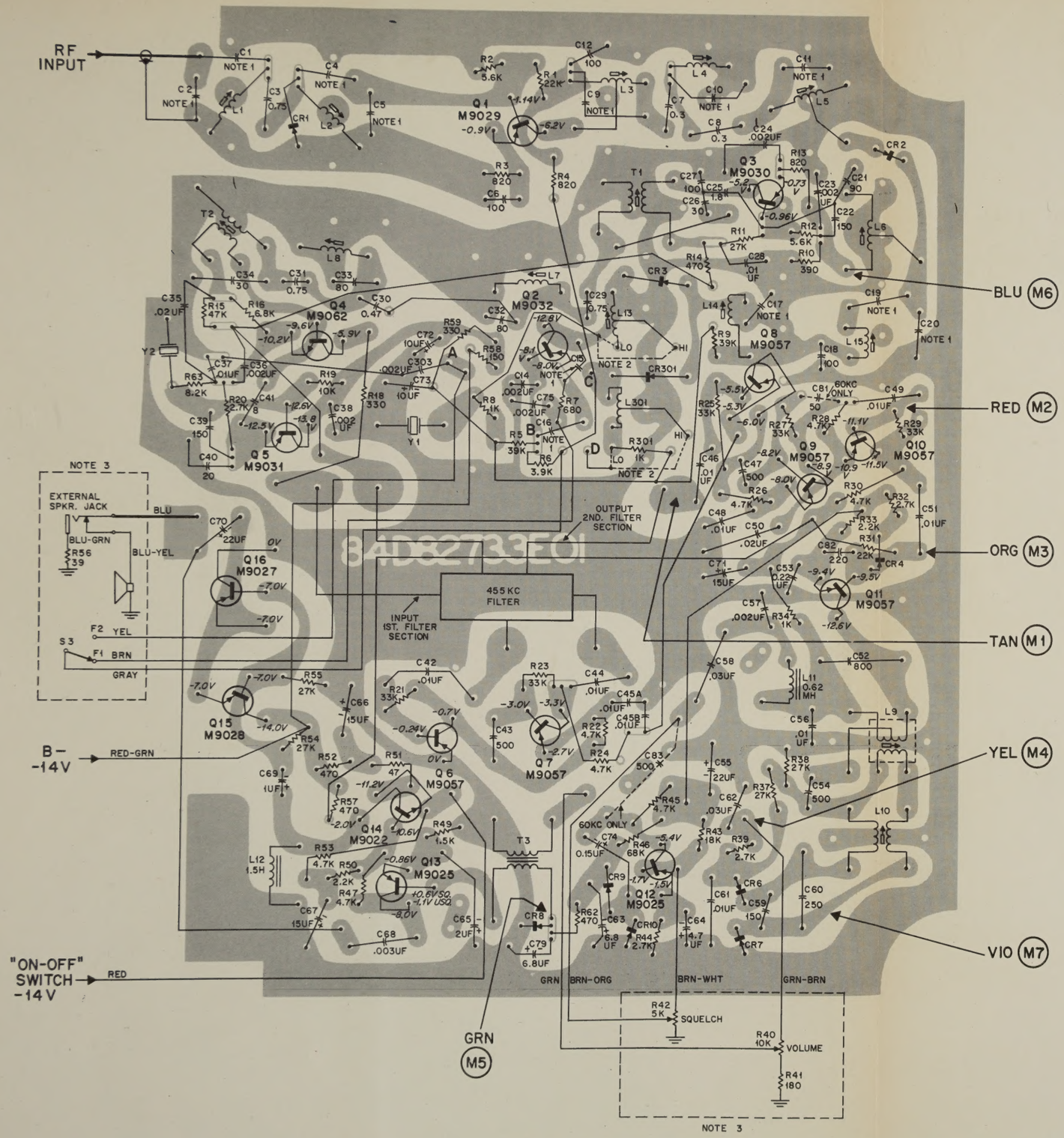
REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
WAS EPD-8142	NRD1131AC-2 NRD1132AC-3 NRD1131AD-2 NRD1132AD-3	C8	WAS 21C82450B25 (0.2 uf)	ABOVE Q3
		C37	WAS 21K861442 (.002 uf)	LEFT OF Q4
		C79	ADDED 23C82397D09 (6.8 uf)	LEFT OF Q12
		R62	ADDED 6K128545 (470)	
		CR8, 9, 10	WERE 48C82363E02	PARTS LIST
		R61	ADDED 6K128557 (4.7K)	Q10 BASE
	NRD1131AC-3 NRD1132AC-4	CR5	REMOVED 48C82178A01 (60 KC)	Q11 BASE
		C82	ADDED 21K868829 (220 uuf)	
		C83	ADDED 21K847065 (500 uuf) (60 KC)	ABOVE Q12
		R61	REMOVED 6K128557 (4.7K)	Q10 BASE
		C81	ADDED 21K864013 (60 KC)	Q9 BASE
	NRD1131AC-4 NRD1132AC-5 NRD1131AD-3 NRD1132AD-4	CR5	REMOVED 48C82178A01 (30 KC)	Q11 BASE EMITTER
		C82	ADDED 21K868829 (220 uuf) (30 KC)	
	NRD1131AC-5 NRD1132AC-6 NRD1131AD-4 NRD1132AD-5	C40	WAS 21K861462 (15 uuf)	Q5 EMITTER
		Q15, 16	BASE VOLTAGES WERE -7.4 V AND EMITTER VOLTAGES WERE -7.4 V	FINAL AUD. AMPL.
	NRD1131AC-6 NRD1132AC-7 NRD1131AD-5 NRD1132AD-6	C65	WAS 23C82397D05 (4.7 uf)	RIGHT OF Q13
		R48	REMOVED 6K129753 (100)	
		C68	WAS 21C82187B11 (1500 uuf)	
	NHN6069A-1 NHN6071A-1 NHN6079A-1 NHN6081A-1 NHN6082A-1 NHN6083A-1	R41	WAS 6K129753 (100)	LOWER RIGHT OF BOARD

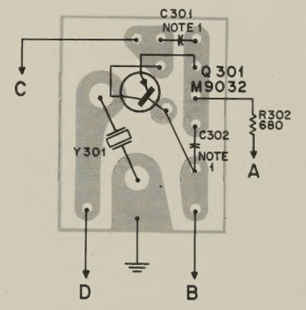
MODEL	SUFFIX
NRD1131AC	2
NRD1132AC	3
NRD1131AD	2
NRD1132AD	3

FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-8142

2-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8453-O



1ST. OSC. CIRCUIT BOARD F2



NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142 & 150.8-162MC RANGE JUMPER TO "LO" CONNECTION.
   FOR UNITS IN 142-150.8 & 162-174MC RANGE JUMPER TO "HI" CONNECTION.
3. PART OF HOUSING KIT.

MODEL CHART

MODEL	SUFFIX
NRD1131AC	2
NRD1132AC	3
NRD1131AD	2
NRD1132AD	3

FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-8142.

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
WAS EPD-8142	NRD1131AC-2 NRD1132AC-3 NRD1131AD-2 NRD1132AD-3	C8	WAS 21C82450B25 (0.2 uf)	ABOVE Q3
		C37	WAS 21K861442 (.002 uf)	LEFT OF Q4
		C79	ADDED 23C82397D09 (6.8 uf)	LEFT OF Q12
		R62	ADDED 6K128545 (470)	
		CR8, 9, 10	WERE 48C82363E02	PARTS LIST
		R61	ADDED 6K128557 (4.7K)	Q10 BASE
	NRD1131AC-3 NRD1132AC-4	CR5	REMOVED 48C82178A01 (60 KC)	Q11 BASE
		C82	ADDED 21K868829 (220 uuf)	
		C83	ADDED 21K847065 (500 uuf) (60 KC)	ABOVE Q12
		R61	REMOVED 6K128557 (4.7K)	Q10 BASE
		C81	ADDED 21K864013 (60 KC)	Q9 BASE
	NRD1131AC-4 NRD1132AC-5 NRD1131AD-3 NRD1132AD-4	CR5	REMOVED 48C82178A01 (30 KC)	Q11 BASE EMITTER
		C82	ADDED 21K868829 (220 uuf) (30 KC)	
	NRD1131AC-5 NRD1132AC-6 NRD1131AD-4 NRD1132AD-5	C40	WAS 21K861462 (15 uuf)	Q5 EMITTER
		Q15, 16	BASE VOLTAGES WERE -7.4 V AND EMITTER VOLTAGES WERE -7.4 V	FINAL AUD. AMPL.
	NRD1131AC-6 NRD1132AC-7 NRD1131AD-5 NRD1132AD-6	C65	WAS 23C82397D05 (4.7 uf)	RIGHT OF Q13
		R48	REMOVED 6K129753 (100)	
		C68	WAS 21C82187B11 (1500 uuf)	
	NHN6069A-1 NHN6071A-1 NHN6079A-1 NHN6081A-1 NHN6082A-1 NHN6083A-1	R41	WAS 6K129753 (100)	LOWER RIGHT OF BOARD

MODEL	SUFFIX
NRD1131AC	2
NRD1132AC	3
NRD1131AD	2
NRD1132AD	3

FOR RECEIVERS SUFFIXED EARLIER THAN INDICATED IN THIS CHART, REFER TO EPD-8142

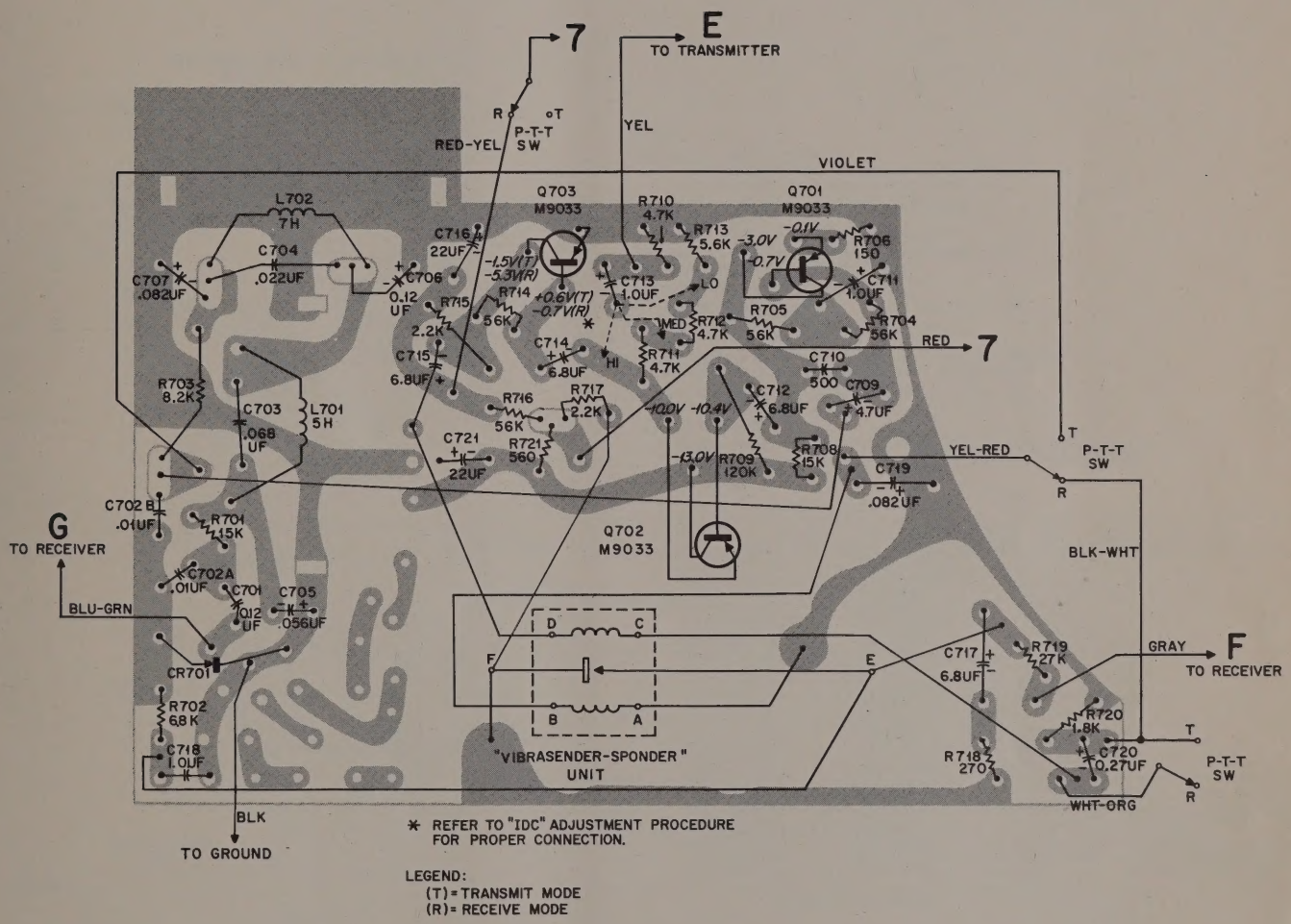
2-Frequency Receiver Printed Circuit Board and Wiring Diagram
Motorola No. EPD-8453-O

CEPD-8288-A

CEPD-8506-A

REVISIONS

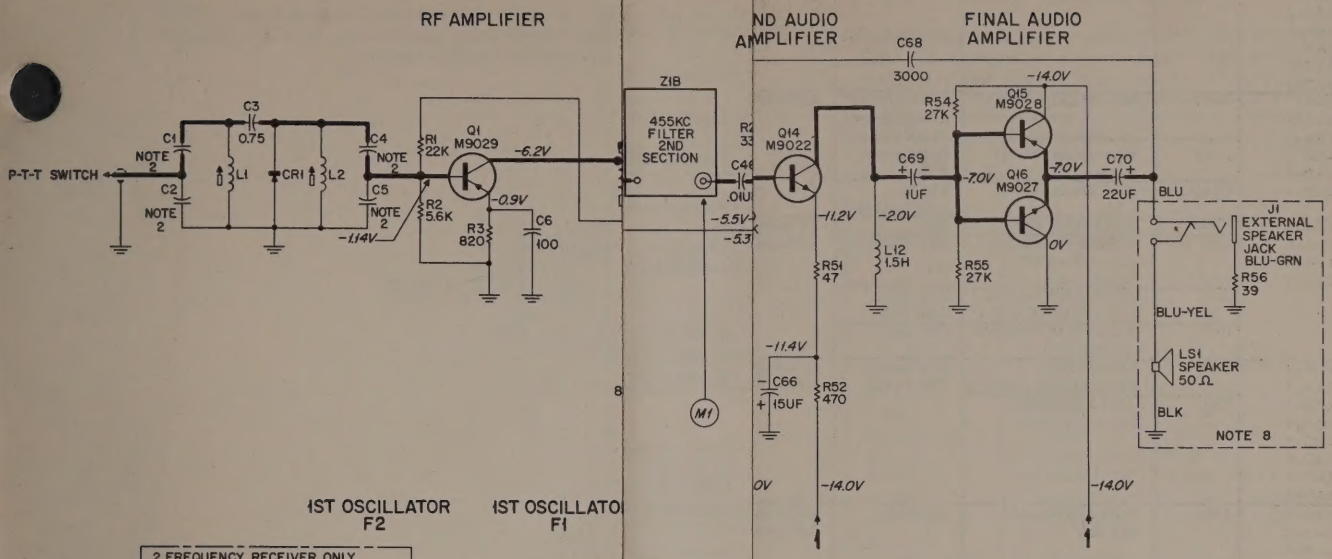
DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NLD6160A	V701, 702, & 703	VOLTAGE READINGS ADDED	

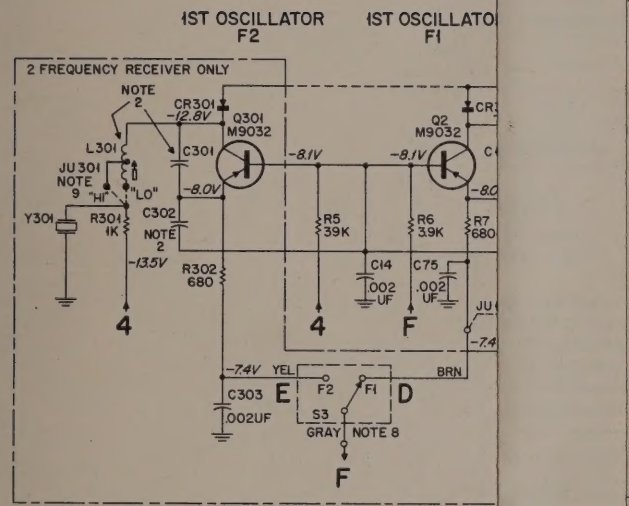


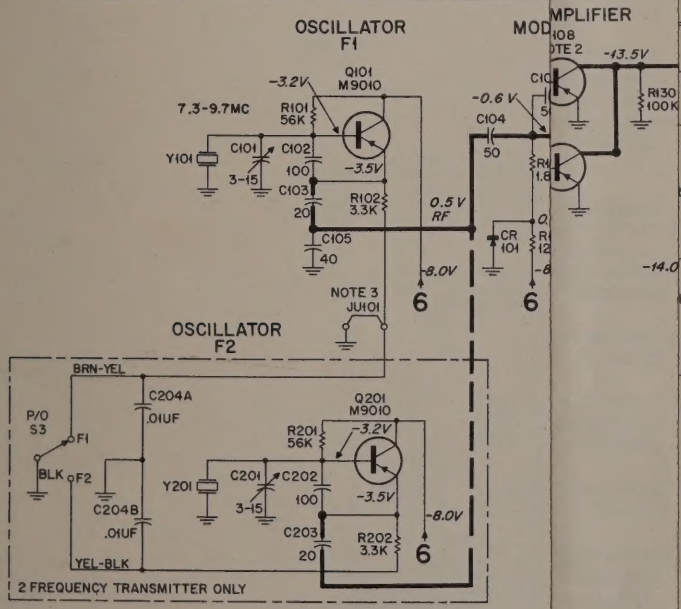
* REFER TO "IDC" ADJUSTMENT PROCEDURE FOR PROPER CONNECTION.

LEGEND:
(T) = TRANSMIT MODE
(R) = RECEIVE MODE

NLD6160A "Private-Line" Printed Circuit Board and Wiring Diagram Motorola No. EPD-8518-A







NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000.
   ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. JUMPER, JU102, MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE.
5. FREQUENCY CALCULATIONS:
   a. TRANSMITTER: $f_o = \frac{f_c}{18}$ b. RECEIVER: $f_o = \frac{f_c - 14.7MC}{3}$
   SEE 2ND OSCILLATOR FREQUENCY TABLE.
6. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
7. THIS IS AN INHERENT CAPACITY WHICH IS PART OF THE HEAT SINK ASSEMBLY.
8. PART OF HOUSING KIT.
9. FOR UNITS IN 132-142 AND 150.8 - 162 MC RANGE JUMPER TO "LO" CONNECTION. FOR UNITS IN 142-150.8 AND 162-174 MC RANGE JUMPER TO "HI" CONNECTION.

MODEL TABLE

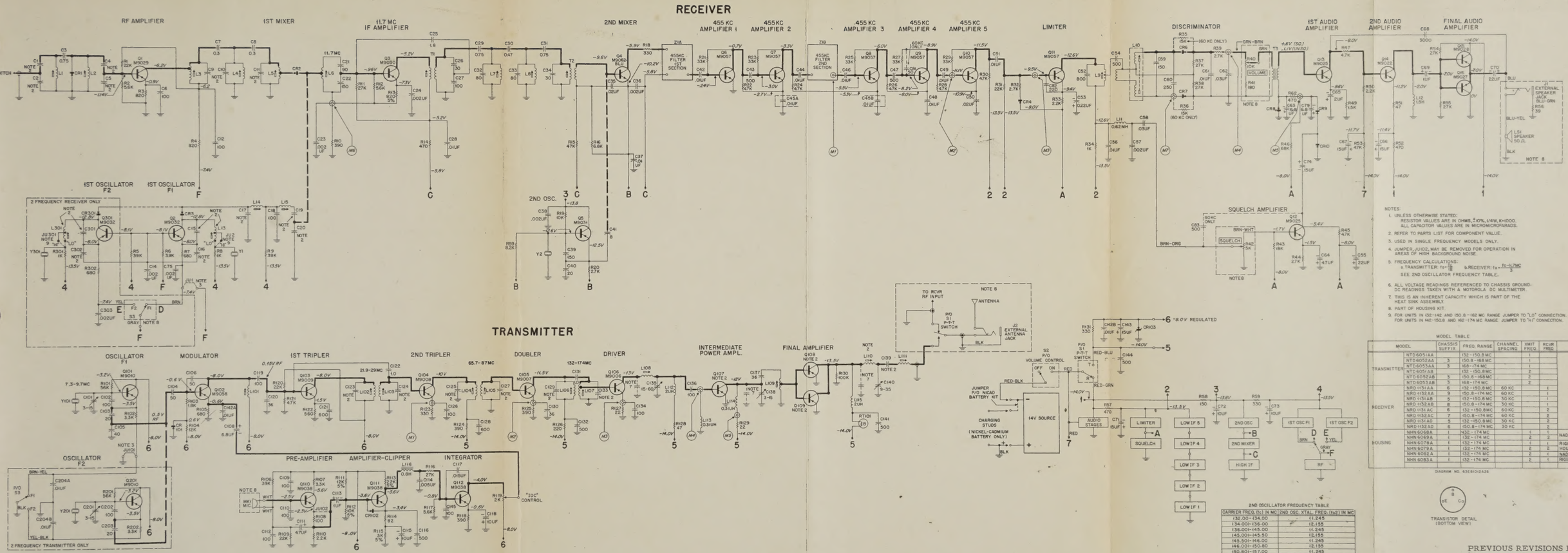
MODEL		CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING	XMIT FREQ.	RCVR FREQ	ANTENNA
TRANSMITTER	NTD6051AA		132-150.8MC		1		
	NTD6052AA	3	150.8-168MC		1		
	NTD6053AA	3	168-174MC		1		
	NTD6051AB		132-150.8MC		2		
	NTD6052AB	3	150.8-168MC		2		
	NTD6053AB	3	168-174MC		2		
RECEIVER	NRD1131AA	6	132-150.8MC	60 KC		1	
	NRD1132AA	9	150.8-174MC	60 KC		1	
	NRD1131AB	5	132-150.8MC	30 KC		1	
	NRD1132AB	8	150.8-174MC	30 KC		1	
	NRD1131AC	6	132-150.8MC	60 KC		2	
	NRD1132AC	7	150.8-174MC	60 KC		2	
	NRD1131AD	5	132-150.8MC	30 KC		2	
	NRD1132AD	6	150.8-174MC	30 KC		2	
HOUSING	NHN6068A	1	132-174MC		1	1	NAD6082A OR NAD6092A
	NHN6069A	1	132-174MC		2	2	
	NHN6078A	1	132-174MC		1	1	RIGID LOOP P/O HOUSING KIT
	NHN6079A	1	132-174MC		2	2	
	NHN6082A	1	132-174MC		2	1	NAD6082A OR NAD6092A
	NHN6083A	1	132-174MC		2	1	RIGID LOOP P/O HOUSING KIT

DIAGRAM NO. 63E81012A26

TRANSISTOR DETAIL (BOTTOM VIEW)

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

H23DCN-1000 Series
Carrier Squelch
Schematic Diagram
Motorola No. 63E81012A26-L



NOTES:

1. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000. ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. JUMPER, JU102, MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE.
5. FREQUENCY CALCULATIONS:
   a. TRANSMITTER: $f_o = \frac{f_c}{18}$ b. RECEIVER: $f_o = \frac{f_c - 11.7MC}{3}$
   SEE 2ND OSCILLATOR FREQUENCY TABLE.
6. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
7. THIS IS AN INHERENT CAPACITY WHICH IS PART OF THE HEAT SINK ASSEMBLY.
8. PART OF HOUSING KIT
9. FOR UNITS IN 132-142 AND 150.8-162 MC RANGE, JUMPER TO "LO" CONNECTION. FOR UNITS IN 142-150.8 AND 162-174 MC RANGE, JUMPER TO "HI" CONNECTION.

MODEL TABLE

MODEL		CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING	XMIT FREQ.	RCVR FREQ.	ANTENNA
TRANSMITTER	NTD6051AA		132-150.8 MC		1		
	NTD6052AA	3	150.8-168 MC		1		
	NTD6053AA	3	168-174 MC		1		
	NTD6051AB		132-150.8 MC		2		
	NTD6052AB	3	150.8-168 MC		2		
	NTD6053AB	3	168-174 MC		2		
RECEIVER	NRD1131AA	6	132-150.8 MC	60 KC		1	
	NRD1132AA	9	150.8-174 MC	60 KC		1	
	NRD1131AB	5	132-150.8 MC	30 KC		1	
	NRD1132AB	8	150.8-174 MC	30 KC		1	
	NRD1131AC	6	132-150.8 MC	60 KC		2	
	NRD1132AC	7	150.8-174 MC	60 KC		2	
	NRD1131AD	5	132-150.8 MC	30 KC		2	
	NRD1132AD	6	150.8-174 MC	30 KC		2	
HOUSING	NHN6068A	1	132-174 MC		1	1	NAD6082A OR NAD6092A
	NHN6069A	1	132-174 MC		2	2	
	NHN6078A	1	132-174 MC		1	1	RIGID LOOP P/O HOUSING KIT
	NHN6079A	1	132-174 MC		2	2	
	NHN6082A	1	132-174 MC		2	1	NAD6082A OR NAD6092A
	NHN6083A	1	132-174 MC		2	1	RIGID LOOP P/O HOUSING KIT

DIAGRAM NO. 63E81012A26

2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (f_c) IN MC	2ND OSC. XTAL. FREQ. (f_{os2}) IN MC
132.00-134.00	11.245
134.001-136.00	12.155
136.001-145.00	11.245
145.001-145.50	12.155
145.501-146.00	11.245
146.001-150.80	12.155
150.801-157.00	11.245
157.001-157.60	12.155
157.601-168.00	11.245
168.001-169.00	12.155
169.001-174.00	11.245

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

H23DCN-1000 Series
Carrier Squelch
Schematic Diagram
Motorola No. 63E81012A26-L

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
RT101	65B82085D01	LAMP, ballast: 250 ma min.; 300 ma max. at 0.5 v
Y101, 201	YN-19	CRYSTAL, quartz: NOTE II xmtr. control
	NON-REFERENCED ITEMS	
	1V80722A99	HEAT SINK BRACKET ASSY.
	1V80723A40	CIRCUIT BOARD ASSY. (riveted)

NHN6068A Housing Kit (1-Freq.)
NHN6069A Housing Kit (2-Freq.)
NHN6078A Housing Kit (1-Freq.)
NHN6079A Housing Kit (2-Freq.)
NHN6082A Housing Kit (2-Freq.)
NHN6083A Housing Kit (2-Freq.)

J1, 2	9C82684D01	JACK, receptacle: does not incl. 15A82688D01 COVER, jack
LS1	50D82660D01	SPEAKER, dynamic: coil imped. 50 ohms; 2-1/4" dia; weatherproof
MK1	50C82162D01	MICROPHONE, magnetic: imped. 1650 ohms at 1 kc
R40	18C82662D01	RESISTOR, variable: 10K; 0.12 w; weatherproof; incl. spst switch
R41	6K129662	fixed: 180 ±10%; 1/4 w
R42	18C82661D01	5K; 0.12 w; weatherproof
R56	6R2085	fixed; 39 ±10%; 1/2 w
S1	1V80723A33	SWITCH, push; contact arrangement; 5 form "C"
S2		part of R40 (on models NHN6068A, NHN6069A, NHN6078A, NHN6082A and NHN6083A
S3	40C82038G01	rotary: dp2p (2-freq.)
	NON-REFERENCED ITEMS	
	1V80723A28	HOUSING ASSY.: used with NHN6068A
	1V80723A77	HOUSING ASSY.: used with NHN6069A and NHN6082A
	1V80724A94	HOUSING ASSY.: used with NHN6078A
	1V80724A93	HOUSING ASSY.: used with NHN6079A and NHN6083A
	36C82659D01	KNOB, control: used with S3
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker: 2 req'd
	36B82681E01	KNOB, control: plain
	36B82681E03	KNOB, control: with BLK dot
	38B82657D01	BUTTON, push

NLN6236A Rear Cover Kit

	1V80723A35	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd
	3S120901	SCREW, #4-40 x 1/2"; 4 req'd

NSN6008A Lapel Speaker Kit

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

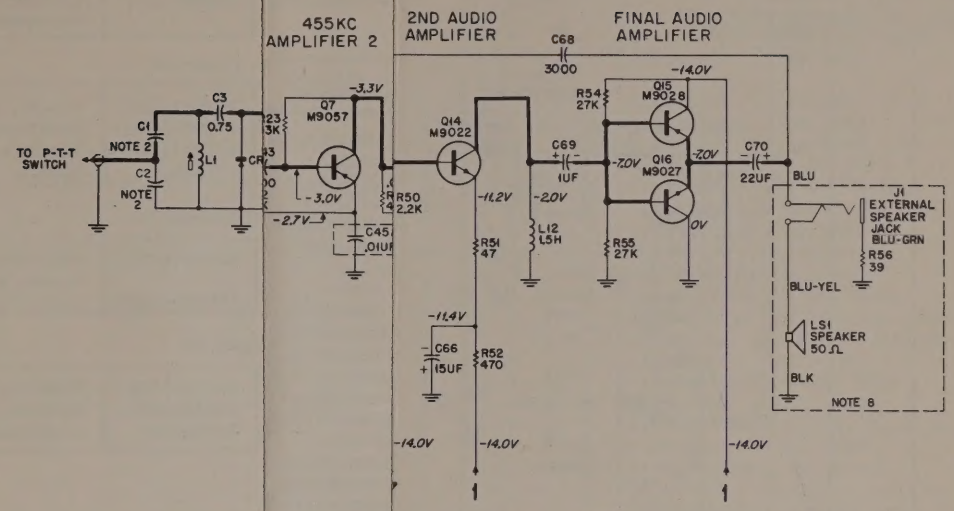
NSN6009A Earpiece Kit

	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.
	42K850709	CLIP, earpiece

NOTES:

I. Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq. (s), crystal freq. (s) and crystal type number.



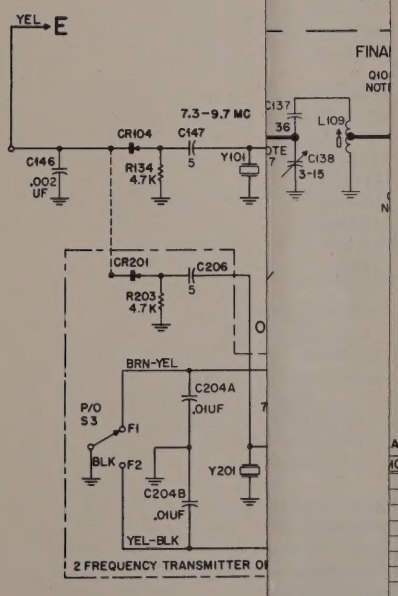
NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000.
   ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. JUMPER, JU102, MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE.
5. FREQUENCY CALCULATIONS:
   a. TRANSMITTER: $fo = \frac{fc}{18}$ b. RECEIVER: $fo = \frac{fc - 11.7MC}{3}$
   SEE 2ND OSCILLATOR FREQUENCY TABLE.
6. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
7. THIS IS AN INHERENT CAPACITY WHICH IS PART OF THE HEAT SINK ASSEMBLY.
8. PART OF HOUSING KIT.
9. S2 IS PART OF VOLUME CONTROL (R40)
10. 132-142 MC AND 150.8-162MC CONNECT JU2 TO POSITION "LO"
    142-150.8MC AND 162-174MC CONNECT JU2 TO POSITION "HI".
11. REFER TO "IDC" ADJUSTMENT PROCEDURE FOR PROPER CONNECTION.

MODEL TABLE

MODEL		CHASSIS SUFFIX	FREQ RANGE	NO. OF FREQ	ANTENNA
TRANSMITTER	NTD6051AC	1	132-150.8 MC	1	
	NTD6052AC	3	150.8-168 MC	1	
	NTD6053AC	3	168-174 MC	1	
	NTD6051AD	1	132-150.8 MC	2	
	NTD6052AD	3	150.8-168 MC	2	
	NTD6053AD	3	168-174 MC	2	
RECEIVER	NRD1131AF	5	132-150.8MC	1	
	NRD1132AF	5	150.8-174 MC	1	
HOUSING	NHN6070A	1	132-174 MC	1	NAD6082A OR NAD6092A
	NHN6071A	1	132-174 MC	2	
	NHN6080A	1	132-174 MC	1	NAD6140A
	NHN6081A	1	132-174 MC	2	

DIAGRAM NO. 63E81012A27



ATOR FREQUENCY TABLE

4C	2ND OSC. XTAL. FREQ. (fo2) IN MC
	11.245
	12.155
	11.245
	12.155
	11.245
	12.155
	11.245
	12.155
	11.245
	12.155
	11.245

TRANSISTOR DETAIL (BOTTOM VIEW)

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

H23DCN-3000 Series
Dual Squelch "Private-Line"
Schematic Diagram
Motorola No. 63E81012A27-H

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
F	NTD6051AA NTD6052AA-2 NTD6053AA-2 NTD6051AB NTD6052AB-2 NTD6053AB-2	C138	WAS 20C82399D06	Q107 BASE	EPD-7929-B
G	NTD6051AA NTD6052AA-3 NTD6053AA-3 NTD6051AB NTD6052AB-3 NTD6053AB-3	C137	WAS 21K865197 (2%)	Q107 COL-LECTOR	EPD-7929-C
		L113	WAS 24C82000E07 (2 uh)	Q107 BASE	
		C141L	WAS 21K861443 (.01)	FINAL AMPLIFIER	
H	NRD1131AA-3 NRD1132AA-6 NRD1131AC-3 NRD1132AC-4	CR5	REMOVED 60 KC	Q11	EPD-8456-O EPD-8453-O
		C82	ADDED 21K868829 (220 uuf) 60 KC ONLY	Q11 BASE	
		C83	ADDED 21K847065 (500 uuf) 60 KC ONLY	Q12 COL-LECTOR	
		R61	REMOVED 6K128557 (4.7K)	Q10 BASE	
J	NRD1131AA-4 NRD1132AA-7 NRD1131AB-3 NRD1132AB-6 NRD1131AC-4 NRD1132AC-5 NRD1131AD-3 NRD1132AD-6	CR5	REMOVED 48C82178A01 (30 KC)	Q11 BASE EMITTER	EPD-8453-O EPD-8456-O
		C82	ADD 21K868829, 220 uuf (30 KC)		
K	NRD1131AA-5 NRD1132AA-8 NRD1131AB-4 NRD1132AB-7 NRD1131AC-5 NRD1132AC-6 NRD1131AD-4 NRD1132AD-5	C40	WAS 21K861462 (15 uuf)	Q5 BASE	EPD-8453-O EPD-8456-O
K1			RCVR. FREQ. CHART ADDED	NOTE 5	
			ANTENNA FOR NHN6078A, NHN6079A AND NHN6083A WAS NAD6140A	MODEL TABLE	
		Q13	BASE VOLTAGE WAS + .57 V	1ST AUD. AMPL.	
		Q15, 16	BASE & EMITTER VOLTAGES WERE -7.4 V	FINAL AUD. AMPL.	
	NTD6051AA NTD6052AA-3 NTD6053AA-3 NTD6051AB NTD6052AB-3 NTD6053AB-3	Q107	COLLECTOR VOLTAGE WAS -11.8 V	INTERM. PWR. AMPL.	EPD-7929-C
L	NRD1131AA-6 NRD1132AA-9 NRD1131AB-5 NRD1132AB-8 NRD1131AC-6 NRD1132AC-7 NRD1131AD-5 NRD1132AD-6	C65	WAS 23C82397D05 (4.7 uf)	1ST AUD. AMPL.	EPD-8453-O EPD-8456-O
		R48	REMOVED 6K129753 (100)		
		C48	WAS 21C82187B11 (1500 uuf)		
	NHN6068A-1 NHN6069A-1 NHN6078A-1 NHN6079A-1 NHN6082A-1 NHN6083A-1	R41	WAS 6K129753 (100)	DISCRIM.	

PARTS LIST for Schematic Diagram 63E81012A26-L

LEGEND
L = 132.150.8 MC
H = 150.8-174 MC

NRD6111AA Receiver Circuit Board (132-150.8 MC) 1-Freq.
NRD6112AA Receiver Circuit Board (150.8-174 MC) 1-Freq.
NRD6111AC Receiver Circuit Board (132-150.8 MC) 2-Freq.
NRD6112AC Receiver Circuit Board (150.8-174 MC) 2-Freq.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±10%; 75 v; unl stated
C1H, 10L, 11L, 19L	21K861430	10; N150
C1L	21K861462	15; N150
C2H, 5L, 20L	21D82877B06	30; N150
C2L	21K861433	36; N150
C3, 29, 31	21C82450B22	0.75; 500 v
C4H, 9L, 10H	21K867807	8 ±5%; N080
C4L	21K861431	12; N150
C5H	21D82877B01	24; N150
C6, 12, 18	21K861437	100; N2200
C7, 8	21C82450B26	0.3; 500 v
C9H, 19H	21D82877B13	7 ±5%; N150
C11H	21D82877B10	6.5 ±0.5 uuf; NP0
C14, 36, 38, 75, 303	21K861442	.002 uf +100-20%
C15H, 301H	21K861427	4; N150
C15L, 17L, 301L	21D82877B17	5 ±5%; N150
C16, 20H, 40, 302	21K861432	20; N150
C17H	21D82877B08	2.8 ±0.25 uuf; NP0
C21	21K864522	90; N080
C22, 39, 59	21D82877B02	150; N1400
C23, 24	21C831126	.002 uf GMV; 300 v
C25	21C82450B30	1.8 ±5%; 500 v
C26, 34	21K864521	30; N750
C27	21K861436	100; N750
C28, 37, 42, 44, 46, 48, 49, 51, 56, 61	21K861443	.01 uf +100-20%
C30	21C82450B24	0.47; 500 v
C32, 33	21K864067	80; N150
C35, 50	21K861444	.02 uf +100-20%
C41	21K861429	8; N150
C43, 47, 54	21K847065	500 GMV; 250 v
C45	21K861469	dual sect. c/o;
C45A		.01 uf +100-20%
C45B		.01 uf +100-20%
C52	21D82239E02	800 ±5%; 200 v
C53	23C82397D06	0.22 uf +40-20%; 35 v
C55, 70	23C82397D16	22 uf ±20%; 15 v
C57	21K864457	.002 uf +100-20%
C58, 62	8C82317B03	.03 uf; 50 v
C60	21D82239E03	250 ±5%; 200 v
C63, 79	23C82397D09	6.8 uf +40-20%; 10 v
C64	23C82397D05	4.7 uf +40-20%; 3 v
C65	23D82397D19	2 uf +40-20%; 8 v
C66, 67, 71	23C82397D17	15 uf ±20%; 20 v
C68	21C82187B16	3000; 100 v
C69	23C82397D07	1 uf +40-20%; 15 v
C72, 73	23C82397D15	10 uf ±20%; 20 v
C74	23C82397D08	0.15 uf +40-20%; 35 v
C82	21K868829	220
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR1	48C82617C01	silicon
CR2	48C859464	germanium
CR3, 301	48C82363E01	silicon
CR4, 6, 7	48C82178A01	germanium
CR8, 9, 10	48C82363E02	silicon
		COIL, RF:
L1, 2, 4	24C82765D01	VIO-BRN; does not incl. 76B82451B04 CORE, tuning
L3	24C82766D01	VIO-RED; does not incl. 76B82451B04 CORE, tuning
L5	24C82766D03	VIO-ORG; does not incl. 76B82451B04 CORE, tuning
L6	24C82766D02	VIO-BLU; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
L7, 8	24C82765D04	VIO-GRAY; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
L9	24C82695D01	limiter: c/o; pri: terminals No. 1 & 2 with No. 5 center tap sec: terminals No. 3 & 4
L10	24B82696D01	discriminator; 455 kc; incl. CORE, tuning
L11	24V80900A61	choke; 0.62 mh; sleeved
L12	25B82751D01	choke; audio: 1.5 h
L13H, 301H	24C82766D05	VIO-YEL; does not incl. 76B82451B02 CORE, tuning or 76A82686D02 SLEEVE, iron (short)
L13L, 301L	24C82766D08	VIO-BLK; does not incl. 76B82451B02 CORE, tuning
L14, 15	24C82765D02	VIO-GRN; does not incl. 76B82451B04 CORE, tuning
		TRANSISTOR: NOTE I
Q1	48R869029	P-N-P; type M9029
Q2, 301	48R869032	P-N-P; type M9032
Q3	48R869030	P-N-P; type M9030
Q4	48K869062	N-P-N; type M9002; GRN
Q5	48R869031	P-N-P; type M9031
Q6, 7, 8, 9, 10, 11	48R869057	P-N-P; type M9057
Q12, 13	48R869025	P-N-P; type M9025
Q14	48R869022	N-P-N; type M9022
Q15	48R869028	P-N-P; type M9028
Q16	48R869027	N-P-N; type M9027
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 31	6K128685	22K
R2, 12	6K129433	5.6K
R3, 4	6K129432	820
R5, 9	6K128903	39K
R6	6K129232	3.9K
R7, 302	6K128599	680
R8, 34, 301	6K127802	1K
R10	6K129863	390
R11, 37, 38, 54, 55	6K127806	27K
R13	6K129818	820 ±5%
R14, 52, 57	6K127801	470
R15	6K128902	47K
R16	6K128687	6.8K
R18, 59	6K129775	330
R19	6K129225	10K
R20, 39, 44, 32	6K128688	2.7K
R21, 23, 25, 27, 29	6K127807	33K
R22, 24, 26, 28, 30, 45, 47, 53	6K127804	4.7K
R33, 50	6K128689	2.2K
R43	6K128904	18K
R46	6K129144	68K
R49	6K127803	1.5K
R51	6K129233	47
R58	6K129862	150
R62	6K128545	470; 1/10 w
R63	6K128560	8.2K
		TRANSFORMER:
T1	24C82767D02	RF: VIO-WHT; does not incl. 76K861425 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
T2	24C82767D01	RF: VIO-VIO; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
T3	25B82699D01	audio input: c/o; pri: imped. 10K ohms; res. 1.34K ohms sec: imped. 1K ohms; res. 348 ohms; coded BLU
		CRYSTAL UNIT, quartz: NOTE II
Y1, 301	YM-35	receiver control
Y2	YN	11.245 mc

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	1V80725A08	PRINTED CIRCUIT BD. ASSY. (2-Freq. Osc.)
	14A82271E02	INSULATOR, coil shield: used with L1, 2, 3, 4, 5, 14, 15
	14A82271E01	INSULATOR, coil shield: used with L13, 301
	26B82671D01	SHIELD, coil: 14 req'd

NLN6234A Resistor-Capacitor Kit (60 KC)

		RESISTOR, fixed:
R35, 36	6K128563	15K ±10%; 1/10 w
		CAPACITOR, fixed: uuf:
C81	21K864013	50 ±10%; 75 v; N150
C82	21K868829	220 ±10%; 75 v; N1400
C83	21K847065	500 GMV; 250 v

FILTER

Z1	NFN6004AS NFN6004AW	FILTER, IF: bandpass: 30 kc bandpass: 60 kc

NLN6273A Diode Limiter Kit (30 KC)

		SEMICONDUCTOR DEVICE, diode: NOTE I
CR5	48C82178A01	germanium

LEGEND
L = 132-150.8 MC
M = 150.8-168 MC
H = 168-174 MC

NTD6051AA Transmitter Chassis (132-150.8 MC) 1-Freq.
NTD6052AA Transmitter Chassis (150.8-168 MC) 1-Freq.
NTD6053AA Transmitter Chassis (168-174 MC) 1-Freq.
NTD6051AB Transmitter Chassis (132-150.8 MC) 2-Freq.
NTD6052AB Transmitter Chassis (150.8-168 MC) 2-Freq.
NTD6053AB Transmitter Chassis (168-174 MC) 2-Freq.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±10% 75 v; unl. stated
C101	20C82399D06	var; 3-15; 200 v; N650
C102, 119, 202	21K861436	100; N750
C103, 203	21K861432	20; N150
C104, 106	21K864013	50; N150
C105	21K861434	40; N150
C108	23C82397D09	6.8 uf +40-20%; 10 v
C109, 110, 112, 126, 134, 136, 145	21K861437	100; N2200
C111	23C82397D05	4.7 uf +40-20%; 3 v
C113	23C82397D07	1 uf +40-20%; 15 v
C114	8C82548E03	.005 uf; 100 v
C115, 118	23C82397D03	10 uf ±20%; 6 v
C116, 132, 141, 144	21K847065	500 GMV; 250 v
C117	8C82548E02	.015 uf; 100 v
C120, 125L, 130, 137	21K861433	36; N150
C121, 128	21K851299	600; 600 v
C122, 131	21C82450B28	1.0; 500 v
C123M, 123H, 124M, 124H	21K864012	60; N150
C123L, 124L	21K861435	70; N150
C125M, 125H, 127M, 127H	21K865197	25; N150
C127L	21D82877B06	30; N150
C129M, 129H	21K861429	8; N150
C129L	21K861462	15; N150
C133M, 133H	21K861428	6; N150
C133L	21K861430	10; N150
C135M, 135H	20C82399D07	var; 15-60; 500 v; N1500
C138, 201	20C82399D01	var; 3-15; 200 v; N650
C139H	21K861427	4; N150
C139M	21K864014	5; N150
C139L	21D82877B08	2.8 ±0.25 uuf; NP0
C140	20C82399D05	var; 9-35; 500 v; N650

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C142, 204	21B861469	2 sect; c/o:
C142A, 204A		.01 uf +100-20%
C142B, 204B		.01 uf +100-20%
C143	23C82397D17	15 uf ±20%; 20 v
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR101	48C82392B03	silicon
CR102	48C82178A01	germanium
CR103	48C82256C08	zener
		COIL,
L101	24C82901B06	BLK; does not incl. 76B82451B02 CORE, tuning; YEL
L102, 103	24C82904B13	RED-RED; does not incl. 76K861425 CORE, tuning
L104, 105	24C82904B17	YEL-BLK; does not incl. 76K861425 CORE, tuning
L106	24C82904B16	GRAY-BLK; does not incl. 76K861425 CORE, tuning
L107	24B82180E01	driver input; does not incl. 76K861425 CORE, tuning
L108	24C82904B06	RED-GRN; does not incl. 76K861425 CORE, tuning
L109	24B82755D01	PA output; does not incl. 76K861425 CORE, tuning
L110M, 110H	24B82754D01	Final Ampl; does not incl. 76K861425 CORE, tuning
L110L	24C82904B18	Final Ampl; GRAY-RED; does not incl. 76K861425 CORE, tuning
L111M, 111H	24C82904B12	VIO-GRAY; does not incl. 76B82451B04 CORE, tuning; BLU
L111L	24C82904B04	BRN; does not incl. 76B82451B04 CORE, tuning
L112, 115	24C82000E07	choke; RF: 2 uh; sleeved
L113, 114	24C82000E08	choke; RF: 0.31 uh; sleeved
L116	25B82872B01	choke; audio: 0.8 h
		TRANSISTOR, P-N-P: NOTE I
Q101, 201	48R869010	type M9010
Q102	48R869058	type M9058
Q103	48R869009	type M9009
Q104	48R869008	type M9008
Q105	48R869007	type M9007
Q106	48R869006	type M9006
Q107L	48R869069	type M9005; BLK
Q107M	48R869005	type M9005
Q107H	48R869056	type M9005; GRN
Q108L, 109L	48R869068	type M9004; ORG
Q108M, 109M	48R869004	type M9004
Q108H, 109H	48K869055	type M9004; VIO
Q110, 111, 112	48R869038	type M9038
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R101, 201	6K129242	56K
R102, 107, 202	6K129231	3.3K
R103	6K129269	1.8K
R104	6K129230	12K
R105	6K128599	680
R106	6K128903	39K
R108	6K129753	100
R109, 120	6K128685	22K
R110	6K128689	2.2K
R111	6K129887	12K ±5%
R112	6K129668	10K ±5%
R113	6K129804	2.2K ±5%
R114	6K129224	82
R115	6S124A60	3K ±5%
R116	6K127806	27K
R117	6K129433	5.6K
R118, 124, 125	6K129863	390
R119	18B82876B02	var; 2K
R121	6K127804	4.7K
R122	6K129620	560
R123, 131	6K129775	330
R126	6K127800	220
R127, 129	6K131641	22
R128	6K129233	47
R130	6K129226	100K

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
RT101	65B82085D01	LAMP, ballast: 250 ma min.; 300 ma max. at 0.5 v
Y101, 201	YN-19	CRYSTAL, quartz: NOTE II xmtr. control
		NON-REFERENCED ITEMS
	1V80722A99	HEAT SINK BRACKET ASSY.
	1V80723A40	CIRCUIT BOARD ASSY. (riveted)

NHN6068A Housing Kit (1-Freq.)
NHN6069A Housing Kit (2-Freq.)
NHN6078A Housing Kit (1-Freq.)
NHN6079A Housing Kit (2-Freq.)
NHN6082A Housing Kit (1-Freq.)
NHN6083A Housing Kit (2-Freq.)

J1, 2	9C82684D01	JACK, receptacle: does not incl. 15A82688D01 COVER, jack
LS1	50D82660D01	SPEAKER, dynamic: coil imped. 50 ohms; 2-1/4" dia; weatherproof
MK1	50C82162D01	MICROPHONE, magnetic: imped. 1650 ohms at 1 kc
R40	18C82662D01	RESISTOR, variable: 10K; 0.12 w; weatherproof; incl. spst switch
R41	6K129662	fixed: 180 ±10%; 1/4 w
R42	18C82661D01	5K; 0.12 w; weatherproof
R56	6R2085	fixed; 39 ±10%; 1/2 w
S1	1V80723A33	SWITCH, push; contact arrangement; 5 form "C"
S2		part of R40 (on models NHN6068A, NHN6069A, NHN6078A, NHN6082A and NHN6083A
S3	40C82038G01	rotary: dp2p (2-freq.)
		NON-REFERENCED ITEMS
	1V80723A28	HOUSING ASSY.: used with NHN6068A
	1V80723A77	HOUSING ASSY.: used with NHN6069A and NHN6082A
	1V80724A94	HOUSING ASSY.: used with NHN6078A
	1V80724A93	HOUSING ASSY.: used with NHN6079A and NHN6083A
	36C82659D01	KNOB, control: used with S3
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker: 2 req'd
	36B82681E01	KNOB, control: plain
	36B82681E03	KNOB, control: with BLK dot
	38B82657D01	BUTTON, push

NLN6236A Rear Cover Kit

	1V80723A35	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd
	3S120901	SCREW, #4-40 x 1/2": 4 req'd

NSN6008A Lapel Speaker Kit

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

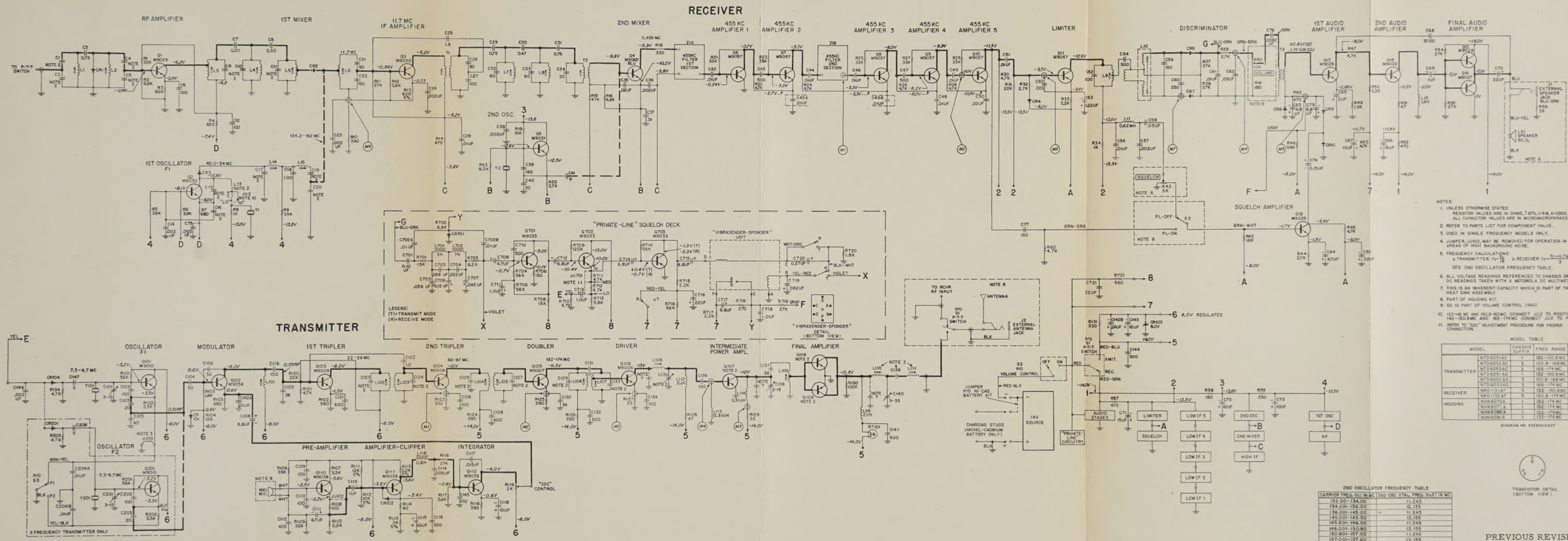
NSN6009A Earpiece Kit

	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.
	42K850709	CLIP, earpiece

NOTES:

I. Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq. (s), crystal freq. (s) and crystal type number.



NOTES:

1. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000. ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. JUMPER J1/J2, MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE.
5. FREQUENCY CALCULATIONS: a. TRANSMITTER: $f_0 = \frac{f_2}{3}$ b. RECEIVER: $f_0 = \frac{f_2 - 11.7\,MC}{3}$

   SEE 2ND OSCILLATOR FREQUENCY TABLE.
6. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
7. THIS IS AN INHERENT CAPACITY WHICH IS PART OF THE HEAT SINK ASSEMBLY.
8. PART OF HOUSING KIT.
9. S2 IS PART OF VOLUME CONTROL (R40).
10. 132-162 MC AND 150.8-162MC: CONNECT J1/J2 TO POSITION "LO". 142-150.8 MC AND 162-174 MC: CONNECT J1/J2 TO POSITION "HI".
11. REFER TO "2DC" ADJUSTMENT PROCEDURE FOR PROPER CONNECTION.

MODEL TABLE

MODEL		CHASSIS P SUFFIX	FREQ. RANGE	NO. OF FREQ.	ANTENNA
TRANSMITTER	NTD6051AC	1	132-150.8 MC	1	
	NTD6052AC	3	150.8-168 MC	1	
	NTD6053AC	3	168-174 MC	1	
	NTD6051AD	1	132-150.8 MC	2	
	NTD6052AD	3	150.8-168 MC	2	
	NTD6053AD	3	168-174 MC	2	
RECEIVER	NRD1131AF	5	132-150.8MC	1	
	NRD1132AF	5	150.8-174 MC	1	
HOUSING	NHN6070A	1	132-174 MC	1	NAD6082A OR
	NHN6071A	1	132-174 MC	2	NAD6092A
	NHN6080A	1	132-174 MC	1	NAD6140A
	NHN6081A	1	132-174 MC	2	

DIAGRAM NO. 63E81012A27

2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (fo) IN MC	2ND OSC. XTAL. FREQ. (fo2) IN MC
132.00-134.00	11.245
134.001-136.00	12.155
136.001-145.00	11.245
145.001-145.50	12.155
145.501-146.00	11.245
146.001-150.80	12.155
150.801-157.00	11.245
157.001-157.60	12.155
157.601-168.00	11.245
168.001-169.00	12.155
169.001-174.00	11.245

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

H23DCN-3000 Series
Dual Squelch "Private-Line"
Schematic Diagram
Motorola No. 63E81012A27-H

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q108L, 109L	48R869068	type M9004; ORG
Q108M, 109M	48R869004	type M9004
Q108H, 109H	48K869055	type M9004; VIO
Q110, 111, 112	48R869038	type M9038
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R101, 201	6K129242	56K
R102, 107, 202	6K129231	3.3K
R103	6K129269	1.8K
R104	6K129230	12K
R105	6K128599	680
R106	6K128903	39K
R108	6K129753	100
R109, 120	6K128685	22K
R110	6K128689	2.2K
R111	6K129887	12K ±5%
R112	6K129668	10K ±5%
R113	6K129804	2.2K ±5%
R114	6K129224	82
R115	6S124A60	3K ±5%
R116	6K127806	27K
R117	6K129433	5.6K
R118, 124, 125	6K129863	390
R119	18B82876B02	var; 2K
R121, 134, 203	6K127804	4.7K
R122	6K129620	560
R123, 131	6K129775	330
R126	6K127800	220
R127, 129	6K131641	22
R128	6K129233	47
R130	6K129226	100K
		LAMP, ballast:
RT101	65B82085D01	250 ma min.; 300 ma max. at 0.5 v
		CRYSTAL, quartz: NOTE II
Y101, 201	YN-19	xmtr. control
NON-REFERENCED ITEMS		
	1V80722A99	HEAT SINK BRACKET ASSY.
	1V80723A40	CIRCUIT BOARD ASSY. (riveted)

NHN6070A Housing Kit (1-Freq.)
NHN6071A Housing Kit (2-Freq.)
NHN6080A Housing Kit (1-Freq.)
NHN6081A Housing Kit (2-Freq.)

		JACK, receptacle:
J1, 2	9C82684D01	does not incl. 15A82688D01 COVER, jack
		SPEAKER, dynamic:
LS1	50D82660D01	coil imped. 50 ohms; 2-1/4" dia; weatherproof
		MICROPHONE, magnetic:
MK1	50C82162D01	imped. 1650 ohms at 1 kc
		RESISTOR, variable:
R40	18C82662D01	10K; 0.12 w; weatherproof; incl. spst switch
R41	6K129662	fixed: 180 ±10%; 1/4 w
R42	18C82661D01	5K; 0.12 w; weatherproof
R56	6R2085	fixed: 39 ±10%; 1/2 w
		SWITCH,
S1	1V80728A68	push: contact arrangement; 5 form "C"
S2		p/o R40
S3	40C82038G01 or40C82038G02	rotary: dp2p (1-freq.) rotary dp4p (2-freq.)
NON-REFERENCED ITEMS		
	1V80724A97	HOUSING ASSY.: used with NHN6070A
	1V80724A99	HOUSING ASSY.: used with NHN6071A
	1V80725A02	HOUSING ASSY.: used with NHN6080A
	1V80725A03	HOUSING ASSY.: used with NHN6081A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	36C82659D01	KNOB, control: used with S3
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker: 2 req'd.
	36B82681E01	KNOB, control: plain
	36B82681E03	KNOB, control: with BLK dot
	38B82657D01	BUTTON, push
	1V80728A70	ANTENNA ASSY.: used with NHN6080A and NHN6081A

NLN6236A Rear Cover Kit

	1V80723A35	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd.
	3S120901	SCREW, #4-40 x 1/2"; 4 req'd.

NSN6008A Lapel Speaker Kit

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

NSN6009A Earpiece Kit

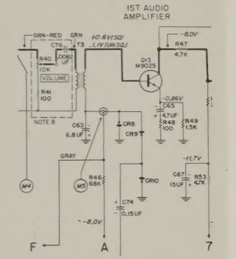
	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.
	42K850709	CLIP, earpiece

NOTES:

I. Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq.(s), crystal freq.(s) and crystal type number.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	NRD1131AF-1 NRD1132AF-1	CR11	REMOVED 48C82361E02	Q14 BASE, EMITTER	EPD-7930-C
B	NRD1131AF-2 NRD1132AF-2	C8	WAS 21C82450B25 (0.2 uuf)	1ST MIXER	EPD-8456-O
		C37	WAS 21K861442 (.002)	Q4	
		C79	ADDED 23C82397D09 (6.8 uf)	1ST AUDIO TEST POINT 5	
		R62	ADDED 6K128545 (470) CIRCUIT WAS AS SHOWN BELOW		
					
		CR8, 9, 10	WERE 48C82363E02	PARTS LIST	
C	NTD6051AC NTD6052AC-1 NTD6053AC-1 NTD6051AD NTD6052AD-1 NTD6053AD-1	C138	WAS 20C82399D06	Q107 BASE	EPD-7929-B
D	NTD6051AC NTD6052AC-2	C137	WAS 21K865197 (25)	Q107 COLLECTOR	EPD-7929-C
	NTD6053AC-2 NTD6051AD NTD6052AD-2 NTD6053AD-2	L113	WAS 24C82000E07 (2 uh)	Q107 BASE	
		C141L	WAS 21K861443 (.01)	FINAL AMPLIFIER	
D1	NRD1131AF-2 NRD1132AF-2	T3	WAS 25B82699D01	PARTS LIST	EPD-8456-O
E	NRD1131AF-3 NRD1132AF-3	CR5	REMOVE 48C82178A01	Q11 BASE, EMITTER	EPD-8456-O
		C82	ADD 21K868829, (220 uuf)		
F	NRD1131AF-4 NRD1132AF-4	C40	WAS 21K861462 (15 uuf)	Q5 BASE	EPD-8456-O
F1		Q15, 16	BASE & EMITTER VOLTAGES WERE -7.4 V	FINAL AUD. AMPL.	
		R43	WAS SHOWN CON- NECTED INSIDE HOUSING KIT	S3	
			RCVR. FREQ. CHART ADDED	NOTE 5	
	NTD6051AC NTD6052AC-2 NTD6053AC-2 NTD6051AD NTD6052AD-2 NTD6053AD-2	Q107	COLLECTOR VOLTAGE WAS -11.8 V	INTERM. PWR. AMPL.	EPD-7929-C
	NLD6160A	V701, 702, 703	VOLTAGE READ- INGS ADDED PRINTED CIRCUIT BOARD REVISED		EPD-8175-A
G	NRD1131AF-5 NRD1132AF-5	C65	WAS 23C82397D05 (4.7 uf)	1ST AUD. AMPL.	EPD-8456-O
		R48	REMOVED 6K129753 (100)		
		C48	WAS 21C82187B11 (1500 uuf)		
	NHN6070A-1 NHN6071A-1	R41	WAS 6K129753 (100)	DISCRIM.	
H	NTD6051AC-1 NTD6052AC-3	C147	WAS 21K861429, 8 uuf	Q101 BASE	EPD-7929-D
	NTD6053AC-3 NTD6051AD-1 NTD6052AD-3 NTD6053AD-3	C206	WAS 21K861429, 8 uuf	Q201 BASE	

PARTS LIST for Schematic Diagram 63E81012A27-H

LEGEND
L = 132-150.8 MC
H = 150.8-174 MC

NRD6111AF Receiver Circuit Board (136-150.8 MC)
NRD6112AF Receiver Circuit Board (150.8-174 MC)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±10%; 75 v; unl stated
C1H, 10L, 11H, 19L	21K861430	10; N150
C1L	21K861462	15; N150
C2H, 5L, 20L	21D82877B06	30; N150
C2L	21K861434	40; N150
C3, 29, 31	21C82450B22	0.75; 500 v
C4H, 10H, 9L	21K867807	8 ±5%; N080
C4L	21K861431	12; N150
C5H	21D82877B01	24; N150
C6, 12, 18	21K861437	100; N2200
C7, 8	21C82450B26	0.3; 500 v
C9H, 19H	21D82877B13	7 ±5%; N150
C11H	21D82877B10	6.5 ±0.5 uuf; NP0
C14, 36, 38, 75	21K861442	.002 uf +100-20%
C15H	21K861427	4; N150
C15L, 17L	21D82877B17	5 ±5%; N150
C16, 20H, 40	21K861432	20; N150
C17H	21D82877B08	2.8 ±0.25 uuf; NP0
C21	21K864522	90; N080
C22, 39, 59, 77	21D82877B02	150; N1400
C23, 24	21C831126	.002 uf GMV; 300 v
C25	21C82450B30	1.8 ±5%; 500 v
C26, 34	21K864521	30; N750
C27	21K861436	100; N750
C28, 37, 42, 44, 46, 48, 49, 51, 56, 61	21K861443	.01 uf +100-20%
C30	21C82450B24	0.47; 500 v
C32, 33	21K864067	80; N150
C35, 50	21K861444	.02 uf +100-20%
C41	21K861429	8; N150
C43, 47, 54	21K847065	500 GMV; 250 v
C45	21K861469	dual sect. c/o;
C45A		.01 uf +100-20%
C45B		.01 uf +100-20%
C52	21D82239E02	800 ±5%; 200 v
C53	23C82397D06	0.22 uf +40-20%; 35 v
C55, 70	23C82397D16	22 uf ±20%; 15 v
C57	21K864457	.002 uf +100-20%
C58, 62	8C82317B03	.03 uf; 50 v
C60	21D82239E03	250 ±5%; 200 v
C63, 79	23C82397D09	6.8 uf +40-20%; 10 v
C64	23C82397D05	4.7 uf +40-20%; 3 v
C65	23D82397D19	2 uf +40-20%; 8 v
C66, 67, 71	23C82397D17	15 uf ±20%; 20 v
C68	21C82187B16	3000; 100 v
C69	23C82397D07	1 uf +40-20%; 15 v
C72, 73	23C82397D15	10 uf ±20%; 20 v
C74	23C82397D08	0.15 uf +40-20%; 35 v
C76	8C82317B06	.0082 uf; 100 v
C82	21K868829	220
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR1	48C82617C01	silicon
CR2	48C859464	germanium
CR3	48C82363E01	silicon
CR4, 6, 7	48C82178A01	germanium
CR8, 9, 10	48C82363E02	silicon
		COIL, RF:
L1, 2, 4	24C82765D01	VIO-BRN; does not incl. 76B82451B04 CORE, tuning
L3	24C82766D01	VIO-RED; does not incl. 76B82451B04 CORE, tuning
L5	24C82766D03	VIO-ORG; does not incl. 76B82451B04 CORE, tuning
L6	24C82766D02	VIO-BLU; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
L7, 8	24C82765D04	VIO-GRAY; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (long)
L9	24C82695D01	limiter: c/o; pri: terminals No. 1 & 2 with No. 5 center tap; sec: terminals No. 3 & 4 discriminator; 455 kc; incl. CORE, tuning
L10	24B82696D01	choke; 0.62 mh; sleeved
L11	24V80900A61	choke; audio: 1.5 h
L12	25B82751D01	VIO-YEL; does not incl. 76B82451B02 CORE, tuning or 76A82686D02 SLEEVE, iron (short)
L13H	24C82766D05	VIO-BLK; does not incl. 76B82451B02 CORE, tuning or 76A82686D02 SLEEVE, iron (short)
L13L	24C82766D08	VIO-GRN; does not incl. 76B82451B04 CORE, tuning
L14, 15	24C82765D02	
		TRANSISTOR: NOTE I
Q1	48R869029	P-N-P; type M9029
Q2	48R869032	P-N-P; type M9032
Q3	48R869030	P-N-P; type M9030
Q4	48K869062	N-P-N; type M9062; BLU
Q5	48R869031	P-N-P; type M9031
Q6, 7, 8, 9, 10, 11	48R869057	P-N-P; type M9057
Q12, 13	48R869025	P-N-P; type M9025
Q14	48R869022	N-P-N; type M9022
Q15	48R869028	P-N-P; type M9028
Q16	48R869027	N-P-N; type M9027
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 31	6K128685	22K
R2, 12	6K129433	5.6K
R3, 4	6K129432	820
R5, 9	6K128903	39K
R6	6K129232	3.9K
R7	6K128599	680
R8, 84	6K127802	1K
R10	6K129863	390
R11, 37, 38, 54, 55	6K127806	27K
R13	6K129818	820 ±5%
R14, 52, 57	6K127801	470
R15	6K128902	47K
R16	6K128687	6.8K
R18, 59	6K129775	330
R19	6K129225	10K
R20, 32, 39, 44	6K128688	2.7K
R21, 23, 25, 27, 29	6K127807	33K
R22, 24, 26, 28, 30, 45, 47, 53, 60	6K127804	4.7K
R33, 50	6K128689	2.2K
R43	6K128904	18K
R46	6K129144	68K
R49	6K127803	1.5K
R51	6K129233	47
R58	6K129862	150
R62	6K128545	470; 1/10 w
R63	6K128560	8.2K
		TRANSFORMER,
T1	24C82767D02	RF: VIO-WHT; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (large)
T2	24C82767D01	RF: VIO-VIO; does not incl. 76K847160 CORE, tuning or 76A82686D01 SLEEVE, iron (large)
T3	25B82053A01	AF: coded GRN; incl.: pri: 1K max; sec: res 200 max.
		CRYSTAL UNIT, quartz: NOTE II
Y1	YM-35	receiver control
Y2	YN	11.245 mc

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	14A82271E02	INSULATOR, coil shield: used with L1, 2, 3, 4, 5, 14, 15
	14A82271E01	INSULATOR, coil shield: used with L13, 301
	26B82671D01	SHIELD, coil: 14 req'd

FILTER

Z1	NFN6004AS	FILTER, IF: bandpass; 30 kc

NLD6160A "Private-Line" Squelch Deck

		CAPACITOR, fixed: uf; ±10%; unl. stated
C701	23D82397D20	0.12 ±20%; 35 v; non-polarized
C702	21B861469	dual sect; c/o:
C702A		.01 +100-20%; 75 v
C702B		.01 +100-20%; 75 v
C703	23D82397D11	.068; 35 v
C704	23D82397D13	.022; 6 v
C705	23D82397D10	.056; 35 v
C706	23D82397D12	0.12; 20 v
C707, 719	23D82397D14	.082; 20 v
C709	23D82397D05	4.7 +40-20%; 3 v
C710	21K847065	500 uuf; GMV; 250 v
C711, 713, 718	23D82397D07	1 +40-20%; 15 v
C712, 714	23D82397D23	6.8 ±20%; 20 v
C715, 717	23D82397D09	6.8 +40-20%; 10 v
C716, 721	23D82397D16	22 ±20%; 15 v
C720	23D82397D25	0.27; 20 v
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR701	48C82392B03	silicon
		COIL, RF: choke;
L701	25C82750D01	5 h
L702	25C82750D02	7 h
		TRANSISTOR: NOTE I
Q701, 702, 703	48R869033	P-N-P; type M9033
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R701, 708	6S127805	15K
R702	6K128687	6.8K
R703	6S128686	8.2K
R704, 705, 714, 716	6K129242	56K
R706	6K129862	150
R709	6K128987	120K
R710, 711, 712	6S127804	4.7K
R713	6K129433	5.6K
R715, 717	6S128689	2.2K
R718	6S129752	270
R719	6K127806	27K
R720	6S129269	1.8K
R721	6K129620	560
		NON-REFERENCED ITEMS
	1V80724A84	PRINTED CIRCUIT BD. ASSY.

LEGEND
L = 132-150.8 MC
M = 150.8-168 MC
H = 168-174 MC

NTD6051AC Transmitter Chassis (132-150.8 MC) 1-Freq.
NTD6052AC Transmitter Chassis (150.8-168 MC) 1-Freq.
NTD6053AC Transmitter Chassis (168-174 MC) 1-Freq.
NTD6051AD Transmitter Chassis (132-150.8 MC) 2-Freq.
NTD6052AD Transmitter Chassis (150.8-168 MC) 2-Freq.
NTD6053AD Transmitter Chassis (168-174 MC) 2-Freq.

		CAPACITOR, fixed: uuf ±10%; 75 v; unl. stated
C101	20C82399D06	var; 3-15; 200 v; N650
C102, 119, 202	21K861436	100; N750
C103, 203	21D82877B20	20; N1400

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C104, 106	21K864013	50; N150
C105	21K861434	40; N150
C108	23C82397D09	6.8 uf +40-20%; 10 v
C109, 110, 112, 126, 134, 136, 145	21K861437	100; N2200
C111	23C82397D05	4.7 uf +40-20%; 3 v
C113	23C82397D07	1 uf +40-20%; 15 v
C114	8C82548E03	.005 uf; 100 v
C115, 118	23C82397D03	10 uf ±20%; 6 v
C116, 132, 141, 141H, 144	21K847065	500 GMV; 250 v
C117	8C82548E02	.015 uf; 100 v
C120, 125L, 130, 137	21K861433	36; N150
C121, 128	21K851299	600; 600 v
C122, 131	21C82450B28	1.0; 500 v
C123M, 123H, 124M, 124H	21K864012	60; N150
C123L, 124L	21K861435	70; N150
C125M, 125H, 127M, 127H	21K865197	25; N150
C127L	21D82877B06	30; N150
C129M, 129H	21K861429	8; N150
C129L	21K861462	15; N150
C133M, 133H	21K861428	6; N150
C133L	21K861430	10; N150
C135M, 135H	20C82399D07	var; 15-60; 500 v; N1500
C138, 201	20C82399D01	var; 3-15; 200 v; N650
C139H	21K861427	4; N150
C139M, 147, 206	21K864014	5; N150
C139L	21K864014	5; N150
C139L	21D82877B08	2.8 ±0.25 uuf; NP0
C140	20C82399D05	var; 9-35; 500 v; N650
C142, 204	21B861469	2 sect; c/o;
C142A, 204A		.01 uf +100-20%
C142B, 204B		.01 uf +100-20%
C143	23C82397D17	15 uf ±20%; 20 v
C146	21K861442	.002 uf +100-20%
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR101	48C82392B03	silicon
CR102	48C82178A01	germanium
CR103	48C82256C08	zener
CR104, 201	48C863140	silicon
		COIL,
L101	24C82901B06	BLK, does not incl 76B82451B02 CORE, tuning: YEL
L102, 103	24C82904B13	RED-RED; does not incl 76K861425 CORE, tuning
L104, 105	24C82904B17	YEL-BLK; does not incl 76K861425 CORE, tuning
L106	24C82904B16	GRAY-BLK; does not incl 76K861425 CORE, tuning
L107	24B82180E01	driver input; does not incl 76K861425 CORE, tuning
L108	24C82904B06	RED-GRN; does not incl 76K861425 CORE, tuning
L109	24B82755D01	PA output; does not incl 76K861425 CORE, tuning
L110M, 110H	24B82754D01	Final Ampl; does not incl 76K861425 CORE, tuning
L110L	24C82904B18	GRAY-RED; does not incl 76K861425 CORE, tuning
L111M, 111H	24C82904B12	VIO-GRAY; does not incl 76B82451B04 CORE, tuning
L111L	24C82904B04	BLU BRN; does not incl 76B82451B04 CORE, tuning
L112, 115	24C82000E07	choke; RF; 2 uh; sleeved
L113, 114	24C82000E08	choke; RF; 0.31 uh; sleeved
L116	25B82872B01	choke; audio; 0.8 h
Q101, 201	48R869010	TRANSISTOR, P-N-P; NOTE I type M9010
Q102	48R869058	type M9058
Q103	48R869009	type M9009
Q104	48R869008	type M9008
Q105	48R869007	type M9007
Q106	48R869006	type M9006
Q107L	48R869069	type M9005; BLK
Q107M	48R869005	type M9005
Q107H	48K869056	type M9005; GRN

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q108L, 109L	48R869068	type M9004; ORG
Q108M, 109M	48R869004	type M9004
Q108H, 109H	48K869055	type M9004; VIO
Q110, 111, 112	48R869038	type M9038
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R101, 201	6K129242	56K
R102, 107, 202	6K129231	3.3K
R103	6K129269	1.8K
R104	6K129230	12K
R105	6K128599	680
R106	6K128903	39K
R108	6K129753	100
R109, 120	6K128685	22K
R110	6K128689	2.2K
R111	6K129887	12K ±5%
R112	6K129668	10K ±5%
R113	6K129804	2.2K ±5%
R114	6K129224	82
R115	6S124A60	3K ±5%
R116	6K127806	27K
R117	6K129433	5.6K
R118, 124, 125	6K129863	390
R119	18B82876B02	var; 2K
R121, 134, 203	6K127804	4.7K
R122	6K129620	560
R123, 131	6K129775	330
R126	6K127800	220
R127, 129	6K131641	22
R128	6K129233	47
R130	6K129226	100K
RT101	65B82085D01	LAMP, ballast: 250 ma min.; 300 ma max. at 0.5 v
Y101, 201	YN-19	CRYSTAL, quartz: NOTE II xmtr. control
		NON-REFERENCED ITEMS
	1V80722A99 1V80723A40	HEAT SINK BRACKET ASSY. CIRCUIT BOARD ASSY. (riveted)

NHN6070A Housing Kit (1-Freq.)
NHN6071A Housing Kit (2-Freq.)
NHN6080A Housing Kit (1-Freq.)
NHN6081A Housing Kit (2-Freq.)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1, 2	9C82684D01	JACK, receptacle: does not incl. 15A82688D01 COVER, jack
LS1	50D82660D01	SPEAKER, dynamic: coil imped. 50 ohms; 2-1/4" dia; weatherproof
MK1	50C82162D01	MICROPHONE, magnetic: imped. 1650 ohms at 1 kc
R40	18C82662D01	RESISTOR, variable: 10K; 0.12 w; weatherproof; incl. spst switch
R41	6K129662	fixed: 180 ±10%; 1/4 w
R42	18C82661D01	5K; 0.12 w; weatherproof
R56	6R2085	fixed: 39 ±10%; 1/2 w
S1	1V80728A68	SWITCH, push: contact arrangement; 5 form "C"
S2		p/o R40
S3	40C82038G01 or40C82038G02	rotary: dp2p (1-freq.) rotary dp4p (2-freq.)
		NON-REFERENCED ITEMS
	1V80724A97	HOUSING ASSY.: used with NHN6070A
	1V80724A99	HOUSING ASSY.: used with NHN6071A
	1V80725A02	HOUSING ASSY.: used with NHN6080A
	1V80725A03	HOUSING ASSY.: used with NHN6081A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	36C82659D01 35A82654D01 15B82651D01 42A82652D01 36B82681E01 36B82681E03 38B82657D01 1V80728A70	KNOB, control: used with S3 DIAPHRAGM, microphone COVER, microphone CLAMP, speaker: 2 req'd. KNOB, control: plain KNOB, control: with BLK dot BUTTON, push ANTENNA ASSY.: used with NHN6080A and NHN6081A

NLN6236A Rear Cover Kit

	1V80723A35 1V80723A36 4C82418B09 3S120901	REAR COVER ASSY. BATTERY COVER ASSY. WASHER, nylon: 4 req'd. SCREW, #4-40 x 1/2": 4 req'd.

NSN6008A Lapel Speaker Kit

	50C82149E01 30B82580D02	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia. CABLE AND PLUGS ASSY.

NSN6009A Earpiece Kit

	50C82151E01 30B82150E01 42K850709	EARPIECE CABLE AND PLUGS ASSY. CLIP, earpiece

NOTES:

I. Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq.(s), crystal freq.(s) and crystal type number.